BARBADOS

ANNUAL REPORT

OF THE

DEPARTMENT OF SCIENCE AND AGRICULTURE

FOR THE YEAR

1951—1952

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DEPARTMENT OF SCIENCE AND AGRICULTURE

STAFF

Director of Agriculture	C. C. SKEETE, O.B.E., B.A.
Deputy Director of Agriculture	VACANT
Entomologist	R. W. E. TUCKER, M.A., (Cantab) B.Ed. (Capetown).
Veterinary Officer	M. B. PROVERBS, M.R.C.V.S.
Assistant Veterinary Officer	VACANT
Chemist	J. B. D. ROBINSON, B.Sc., Agric. (Hons.)
Government Analyst	N. CARMICHAEL, B.Sc., (McGill) M.Sc., (Western), A.R.I.C., (London).
Cultivation Officer	W. H. C. KNOWLES, A.I.C.T.A.
Irrigation Officer	A. D. HERBERT, D.I.C.T.A.
Co-operative Officer	C. A. E. BECKLES, D.I.C.T.A.
Fishery Officer	D. W. WILES
Assistant Livestock Officer	A. G. F. SEALE
Plant Diseases Inspector	D. R. D. WILES, D.I.C.T.A.
Office Superintendent	H. O. RAMSEY
Senior Clerk	G. D. RAMSEY
do. do.	A. S. INNISS
Clerk	C. B. LONG
Clerk	J. K. DRAYTON
Clerk	E. F. OXLEY
Clerk	F. B. TAYLOR
Clerk	E. Mc.D. RUSSELL
Clerk	W. W. IFILL
Clerk	K. A. HUTCHINSON (Ag.)

Stenographer-Typist	Miss N. E. Callender
do. do.	Miss E. V. Beckles
Senior Agricultural Assistant	C. B. Foster
do. do. do.	H. E. Ward
Agricultural Assistant	L. H. Atkinson
do. do.	J. E. Clarke
do. do.	T. O. Hoyte
Farm Manager, Central Livestock Station, Pine Plantation	H. E. Kirton
Farm Overseer, Central Livestock Station ..	A. G. Holder
Farm Overseer, Pine Plantation	M. E. Murrell
Senior Peasant Agricultural Instructor ..	C. A. E. Beckles, D.I.C.T.A., (Ag.)
Peasant Agricultural Instructor	G. B. Pilgrim
do. do. do.	L. T. Talma
do. do. do.	G. A. Ramsay
do. do. do.	C. D. Spooner
do. do. do.	E. S. Brathwaite
do. do. do.	F. M. Cummins
do. do. do.	V. F. Gay
do. do. do.	A. Yard
do. do. do.	E. G. St. John
do. do. do.	H. DaC. Sealy
do. do. do.	C. V. Drayton
do. do. do.	C. A. Riley
do. do. do.	A. J. Bellamy
do. do. do.	J. E. Wason
do. do. do.	D. A. Corbin
do. do. do.	E. L. Murray

Senior Analytical Assistant	H. A. JONES
do. do. do.	L. A. HALL
Analytical Assistant	R. E. BARROW
do. do.	E. W. MAXWELL
do. do.	K. H. STREAT
do. do.	D. A. WICKHAM
Entomological Assistant	W. HEADLEY
Field Assistant	V. E. JAMES
Wood Ant Inspector	F. C. GREENE
Government Laboratory Attendant ..	H. A. WHARTON
Entomological Laboratory Attendant ..	A. GITTENS
Overseer—Codrington Station	F. A. PERKINS
Assistant Gardener	F. A. JORDAN
Agricultural Department Messenger ..	G. BARKER
Government Laboratory Messenger ..	L. H. MOORE

COLONIAL DEVELOPMENT & WELFARE SCHEMES

Scheme D.217 — Agricultural Development.

Secretary, Barbados Dairy and Stock Breeders' Association	C. O'NEAL

Mr. C. C. Skeete, O.B.E., B.A., Director of Agriculture, was granted three days' duty leave from the 21st of January, 1952, to attend a meeting of the Governing Body of the Eastern Caribbean Farm Institute, which was held in Trinidad. During his absence, Mr. R. W. E. Tucker, M.A., B.Ed., Entomologist, acted as Director of Agriculture.

Mr. J. B. D. Robinson, B.Sc., A.R.I.C., Chemist, and Mr. W. H. C. Knowles, A.I.C.T.A., Cultivation Officer, visited British Guiana, on fourteen days' duty leave, for the purpose of attending the B.W.I. Sugar Technologists Conference which was held from 24th October to 5th November, 1951.

Mr. N. Carmichael, B.Sc., M.Sc., A.R.I.C., was appointed, on a three year contract, to the vacant post of Government Analyst, commencing from the 1st of October, 1951.

Dr. M. B. Proverbs, M.R.C.V.S., Government Veterinary Officer, proceeded to St. Vincent on the 20th of March, 1952, on seven days' duty leave, to examine the government livestock at Camden Park Experiment Station and the Ottley Hall Prison Farm. His duties were performed by Dr. C. P. Stoute, Superintendent of the Public Market.

Mr. G. C. Stevenson, B.A., A.I.C.T.A., Cytogeneticist, of the B.W.I. Central Sugar Cane Breeding Station, was granted duty leave as follows:—

Eleven days from the 1st April, 1951, for the purpose of paying an advisory visit to the sugar estates in Guadeloupe; nine days from the 17th of July to observe the progress made in St. Lucia and Grenada with sugar cane varieties supplied from Barbados; and

Fourteen days from the 23rd of October, 1951, in order to visit Trinidad in connection with sugar cane variety problems and to attend the meeting of the B.W.I. Sugar Technologists in British Guiana.

Mr. Stevenson left the colony on 14th March, 1952, for the United Kingdom on six months' vacation leave.

Mr. A. D. Herbert, D.I.C.T.A., Irrigation Officer, spent two months' vacation leave in Canada from the 2nd of June, 1951.

Mr. C. A. E. Beckles, D.I.C.T.A., Senior Peasant Agricultural Instructor, attended the Summer School Co-operative Course which was held in Jamaica from August 6th to 16th, 1951. Shortly after his return to Barbados, he was appointed to the vacant post of Co-operative Officer with effect from the 17th of September, 1951, on the understanding that he would carry out the duties of that office in conjunction with those of Senior Peasant Agricultural Instructor until such time as the latter post is filled.

Consequent on financial assistance provided from Colonial Development and Welfare funds, Mr. Beckles was also enabled to pay a short visit of about four weeks, beginning on the 15th November, 1951, to British Guiana and to Trinidad, to study co-operative organisation and the methods adopted in the development of the co-operative movement in those colonies.

Mr. D. W. Wiles, Fishery Officer, was granted thirteen days' duty leave with effect from the 8th of November, 1951, for the purpose of attending the Fourth Session of the Gulf and Caribbean Fisheries Institute.

BRITISH WEST INDIES CENTRAL SUGAR CANE BREEDING STATION

ADVISORY COMMITTEE

Chairman— C. C. Skeete, O.B.E., B.A., Director of Agriculture, Barbados.

Members — H. J. Page, O.B.E., B.Sc., F.R.I.C., F.I.R.I., Principal of the Imperial College of Tropical Agriculture, Trinidad.

— C. H. B. Williams, Director of Agriculture, Trinidad.

— R. F. Innes, Director of Research, Sugar Manufacturers' Association (of Jamaica) Ltd., (nominee of the Director of Agriculture, Jamaica).

— H. H. Croucher, B.Sc., A.I.C.T.A., Director of Agriculture, British Guiana.

— E. R. H. Martin, Assistant Agricultural Superintendent, Antigua.

— Sir John Saint, Kt., C.M.G., O.B.E., Director, Sugar Technology Laboratory, Barbados.

— M. A. G. Hanschell, Director of Agriculture, Grenada.

STAFF

Cytogeneticist	— G. C. Stevenson, B.A., (Hons.) Cantab., A.I.C.T.A.
Botanist	— B. deL. Inniss, B.Sc., A.I.C.T.A.
Agricultural Assistant	— N. L. Foster.
do.	— C. D. Gilkes.
do.	— B. E. Williams.
Statistical Clerk	— E. L. Jones.
Stenographer-Typist	— Miss S. O. Maxwell.

BOARD OF AGRICULTURE

The members of the Board of Agriculture appointed for the Legislative Session 1951-52 were as follows:—

The Hon. G. D. L. Pile, O.B.E., M.L.C., Chairman.
„ „ J. A. Mahon, M.L.C.
Sir John Saint, Kt., C.M.G., O.B.E.
F. L. Walcott, Esq., M.C.P.
E. St. A. Holder, Esq., M.C.P.
J. A. Haynes, Esq., B.A., M.C.P.
L. E. Smith, Esq., M.C.P.
C. O. Armstrong, Esq.

The Director of Agriculture is an *ex officio* member of the Board.

REPORT ON THE WORK OF THE DEPARTMENT OF SCIENCE AND AGRICULTURE FOR THE YEAR ENDING 31ST MARCH 1952

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SUMMARY OF AGRICULTURAL POLICY

1. The conservation of soil and the maintenance and improvement of soil fertility.

2. The control of pests and diseases of crops.

3. The improvement of crop yields by selection and breeding.

4. The maintenance of a sound animal husbandry industry as an integral part of the farming system.

5. The development and improvement of the Fishing Industry.

6. The encouragement of the production of local food crops, especially green vegetables.

7. The stimulation of co-operative ventures, particularly amongst small holders.

8. The development of irrigation in suitable areas.

PART II.

GENERAL

I. WEATHER CONDITIONS DURING THE YEAR

Detailed climatic data in respect of the current year 1951, as recorded at the Meteorological Station at Codrington, St. Michael, are given in Appendix I to this Report. It is an acknowledged fact that water is the principal factor limiting growth in Barbados, and since the water supply is almost entirely dependent on rainfall, the monthly average rainfall for the Colony is an important item to record. The average rainfall for the period December 1949 —March 1951, which covers the growing period of the plant cane, compared with the average rainfall for the two previous fifty-year periods, are set out in Table I.

TABLE I.

MONTH	Rainfall in Inches		
	Average		Average 1949-51
	1849-98	1899-1948	
December	4.90	4.62	3.51
January	3.64	3.04	6.06
February	2.32	1.86	1.95
March	1.96	1.87	2.86
April	2.45	2.14	1.17
May	3.61	2.69	6.56
June	5.62	5.15	10.99
July	6.03	6.52	3.37
August	7.61	7.04	10.01
September	7.95	7.48	7.24
October	8.18	7.32	13.52
November	8.11	7.47	11.26
December	4.96	4.56	4.68
January	3.69	3.09	3.45
February	2.30	1.87	14.35
March	1.99	1.88	2.28
Total	75.32	68.60	103.26

The average monthly rainfall figures for the Island for the sixteen-month period, December 1949 to March 1951, when compared with the average figures for the previous two fifty-year averages, show that the rainfall was considerably above average for nine months of the period, as well as in total quantity, and that on the whole, the distribution was very good. It will be noted that the rains which occurred in February, 1951 were most exceptional, there being no similar occurrence recorded in the month of February during the last century.

II. AGRICULTURAL CROPS

A. SUGAR CANE

(a) Production

The yield of sugar cane reaped during 1951 was the equivalent of 187,643 tons sugar. This was made up of 163,313 tons Vacuum pan sugars, 1,253 tons

Muscovado sugar, 7,615,314 wine gallons Fancy Molasses, which, equated on the basis of 330 wine gallons of Fancy Molasses to the ton of sugar, is the equivalent of 23,077 tons sugar.

The sugar production in Barbados for the past six years is set out in Table II.

TABLE II.

Sugar Production for the Period 1946–1951

	1946	1947	1948	1949	1950	1951
Vacuum Pan Sugar ..	111,933	86,369	56,496	133,868	141,706	163,313
Muscovado Sugar ..	1,377	1,655	1,262	1,991	1,276	1,253
Fancy Molasses	20,410	23,208	20,468	16,872	15,201	23,077
	133,720	111,232	78,226	152,731	158,183	187,643

(b) Export of Sugar and Local Consumption

The colony's entire exportable surplus of sugar was purchased by the Ministry of Food. The export of sugar is still regulated by the Sugar Production and Export Control Board of which the Director of Agriculture is Chairman. Care is exercised to ensure that the requirements of the local market are provided for.

The position with regard to local consumption and export during the period September 1950 to August 1951 is as follows:—

	Tons	Tons
Estimated stocks in hand at 1st September, 1950:—		
Fancy molasses for export	9,009	
Sugar for export	8,892	
Sugar in wholesalers' hands	6,092	23,993
Production during 1951		187,643
		211,636
Estimated stocks in hand at 1st September, 1951:—		
Fancy molasses for export	14,587	
Sugar for export	24,744	
Sugar in wholesalers' hands	5,880	45,211
		166,425
Total exports as per Customs returns, for the period:—		
Fancy molasses	17,031	
Sugar	147,445	164,476
Difference representing Sugar left in the hands of merchants for local consumption		1,949

By the end of December 1951 most of the sugar for export had been exported.

(c) Fancy Molasses

The Barbados Fancy Molasses industry continues to be under the control of the Fancy Molasses Control and Marketing Board of which the Director of Agriculture is Chairman.

At the end of December, 1950 some 4,300 puncheons of the 1950 Fancy Molasses crop remained to be shipped. The Fancy Molasses Control and Marketing Board allocated some 69,200 puncheons for production during 1951 for export. Of this quantity, some 43,700 puncheons were manufactured by small fancy molasses plants and the remainder by vacuum pan factories.

The quantity of fancy molasses which the importing markets required out of the 1952 crop production was 33,000 puncheons. This figure is well below that of recent years.

(d) The Special Funds for the Benefit of the Sugar Industry and the Welfare of the Workers.

As was done since the 1947 crop sugars purchased by the Ministry of Food, a sum of £2 15s. per ton was included in the price for 1951 crop sugars. During this year the Domestic Sugar Agreement provided for the collection of an additional levy of $1.80 (7s. 6d.) and the total sum of $15.00 (£3 2s. 6d.) has been paid into the following funds at the rates shown:—

Sugar Industry Rehabilitation Reserve Fund 20/- per ton

Sugar Industry Price Stabilization Reserve Fund 20/- per ton.

Labour Welfare Fund 22/6 per ton.

The Sugar Industry Rehabilitation Reserve Fund continues to be administered by the Sugar Industry Capital Rehabilitation Reserve Board, of which the Director of Agriculture is Chairman. The major portion of the funds collected has been paid out in accordance with Regulations made under the principal Act.

The Sugar Industry Price Stabilization Reserve Fund is administered by the Sugar Industry Price Stabilization Reserve Board of which the Director of Agriculture is Chairman. The amounts accruing to this fund have been deposited with the local banks and are earning interest. The purpose of this fund is to mitigate the adverse effect of a reduction in the price of sugar.

The Labour Welfare Fund is administered by the Governor-in-Executive Committee.

(e) Acreage under Cane.

Under the Sugar Cane Census Act, 1937-31, it is compulsory for all landholders with more than ten acres of land to make a return to the Department of Agriculture showing the acres of cane, and the various varieties to be reaped during the ensuing crop season.

The results of the census for the 1952 crop are presented in Table III together with the corresponding figures for the years 1943 to 1951 inclusive.

The acreage of cane grown by small-holders is estimated at 8,500 acres.

TABLE III

Acreage of Sugar Cane reaped in the years 1943–52

Year	ACREAGES								
	Plantations							Small Holders (estimated)	Total
	Plant Canes	First Ratoons	Second Ratoons	Third Ratoons	Fourth Ratoons	Fifth Ratoons	Sixth, Seventh and Ninth Ratoons		
1943	15,374.95	10,004.44	3,629.84	1,235.49	293.74	6.86	—	7,000	37,545.32
1944	14,144.22	10,557.28	4,203.08	814.51	72.82	4.50	—	7,000	36,796.41
1945 ...	14,551.53	9,744.58	4,756.20	865.70	52.02	1.34	—	7,000	36,971.37
1946	14,056.25	11,614.50	5,578.25	1,817.50	51.25	6.00	—	7,000	40,123.75
1947	13,365.25	11,569.00	6,501.00	1,771.50	257.25	2.25	—	7,000	40,466.25
1948	13,480.75	10,614.00	6,281.00	2,126.75	255.50	28.00	—	7,000	39,786.00
1949	13,869.56	10,911.46	5,249.99	2,090.72	370.49	33.00	—	7,000	39,705.22
1950	13,435.78	11,785.71	6,350.76	2,147.50	415.25	53.00	17.25	7,000	41,241.25
1951	12,555.14	11,833.17	7,137.28	2,869.35	558.28	52.00	15.50	8,000	43,020.72
1952	11,531.99	11,519.78	8,344.59	3,813.25	946.27	59.75	24.00	8,500	44,739.63

(f) Variety Acreages

These were obtained from plantation returns of the variety acreages to be reaped each year. The variety percentages for all crops for the year 1943 to 1952 are presented in Table IV.

TABLE IV.

Percentages of Acreages of Sugar Cane Varieties recommended by the Department and other varieties reaped during the period 1943-52.

Percentages of Totals

Varieties	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952
B.2935	20.95	4.73	1.94	0.68	0.26	0.23	0.09	0.04	—	—
B.H.10(12) ..	12.69	8.00	4.76	3.19	2.49	1.36	0.33	0.09	—	—
B.726	9.58	4.79	2.95	2.02	1.26	0.70	0.15	0.03	—	—
Mixed & other varieties ..	11.14	8.50	4.83	2.55	1.25	0.52	0.39	0.47	2.08	1.16
B.3439	8.35	9.49	4.89	2.40	0.54	0.25	0.12	0.06	—	—
B.37161	26.77	48.69	62.65	74.52	83.83	90.00	92.76	90.80	84.76	80.06
B.35187	10.19	11.28	10.19	6.09	3.25	1.91	0.98	0.53	—	—
B.34104	—	4.19	7.46	6.89	3.83	1.24	0.32	0.12	—	—
B.4098	0.33	0.33	0.33	1.56	3.00	3.43	4.14	4.93	5.82	6.87
B.41227	—	—	—	0.06	0.08	0.06	0.14	0.49	0.76	0.89
B.41211	—	—	—	0.04	0.21	0.30	0.58	2.44	6.58	9.74
B.43391	—	—	—	—	—	—	—	—	—	1.28

It will be seen from the above Table that of the total acreage reaped by plantations in 1952, B.37161 occupied 80.06 per cent, a decrease of 4.70 per cent as compared with 1951. The acreage of B.41211 increased by 3.16 per cent, that of B.4098 and B.41227 by 1.05 per cent, and 0.13 per cent, respectively.

III. SOME ASPECTS OF THE ORGANISATION AND WORK OF THE DEPARTMENT OF AGRICULTURE IN THE YEAR UNDER REVIEW

(a) Continued staff shortages.

The post of Deputy Director of Agriculture remained unfilled throughout the year. One of the main duties of this officer is to undertake the direction and supervision of agricultural extension work in small holdings. In the absence of such an officer, progress in this work has been inevitably slow.

The post of Government Analyst was not filled until October 1951. Consequently for the first half of the year it was necessary for the Agricultural Chemist to continue to set aside his own work in order to perform the duties of Government Analyst.

(b) Library.

It was not possible to secure the services of an officer suitably qualified to undertake the organisation of the library. It is recorded with great regret that the library remains in a chaotic condition and is consequently of little value to the staff of the Department.

IV. SOIL CONSERVATION

Professor F. Hardy, C.B.E., Professor of Soil Science at the Imperial College of Tropical Agriculture, Trinidad, visited the Island in January 1951 to make a preliminary examination of the condition of the "Scotland District" in regard to soil erosion. As a result of his visit a team of two surveyors from the B.W.I. Soils Research Scheme were sent to undertake a reconnaissance soil survey of the district at the beginning of the year.

Later in the year a Scotland District Conservation Board was set up "to study the problem of the conservation of land in the Scotland District and to advise the Government of Barbados in regard to measures to be taken, initially and from time to time, to effect its solution." The problem of soil erosion and possible methods of approach to its solution were outlined to the Board at its first meeting in January 1952. Acting on Professor Hardy's advice, the Board recommended to Government that, as a first step, the services of an expert soil conservationist be obtained to advise on measures which should be taken to arrest the rapid deterioration of the district and to effect conservation. The visit of the conservationist had not been arranged by the end of the year.

PART III.

SECTION I.

PEASANT AGRICULTURE

BY

C. A. E. BECKLES

Ag. Senior Peasant Agricultural Instructor

A. General Conditions during the Year.

The Weather. Relatively good weather conditions for the farmer prevailed throughout 1951. The first few months of 1952, however, were very dry with consequent adverse effects on the mature cane crop.

The Main Food Crops. Good April showers rendered conditions suitable for early cultivation and planting of the main food crops. Owing to the protracted cane reaping season, however, peasants for the most part were late in preparing their land for the growing of food. This resulted in disappointing yields of yams, sweet potatoes and most of the other main food crops. Sweet potatoes, especially, were in very short supply during the early part of 1952.

Sugar Cane. Although yields fell short of the record established in the previous year, good crops especially of plant canes were harvested on peasant holdings. The ratoon canes suffered as a result of the late reaping of the previous crop, as well as from the effects of the very dry spell during the harvesting period. The following are some yield data for peasant as well as estate growers:—

Sugar Cane Delivered to all Factories in 1952.

Estates (*tons*)	*Peasants* (*tons*)	*Total* (*tons*)	*Peasants' Canes as per cent of Totals*
1,221,701	285,903	1,507,604	18.96

Average number of Tons of Cane per Acre reaped in 1952

	Area (*acres*)	*Yield* (*tons*)	*Average Yield per acre* (*tons*)
Estates	36,239	1,221,701	33.71
Peasants	8,500	285,902	33.63

TABLE I.

Summary of Sugar Cane Yield Data, 1946—52

Sugar Cane Delivered to all Factories

Year	Total Crop (tons)				Average No. of Tons Per Acre Reaped	
	Estates	Peasants	Total	Peasants as per cent of total	Estates	Peasants
1946	946,345	158,537	1,104,882	14.00	28.57	22.65
1947	866,662	122,443	989,105	12.38	25.89	17.49
1948	641,044	77,211	718,255	10.75	19.50	11.03
1949	1,122,072	184,524	1,306,596	14.12	34.31	26.36
1950	1,118,003	198,903	1,316,906	15.04	32.65	28.41
1951	1,402,671	288,806	1,691,477	17.07	40.05	36.01
1952	1,221,701	285,902	1,507,604	18.96	33.71	33.63

Minor Crops. Among the principal minor crops produced by peasants are cotton, groundnuts, okras, fruits and "green" vegetables. Cotton is dealt with elsewhere in this report. It is of interest to note, however, that within recent years there has been a marked tendency among peasants to concentrate on sugar cane to the almost complete exclusion of cotton or other cash crops. This is due mainly to the comparatively high prices paid for canes and the suitability of the weather during the past three or four years for ratooning this crop. One result of this tendency has been an increase each year in the area grown to sugar cane, and a consequent decrease in the area grown to cotton or other cash crops.

There is always a good demand for groundnuts which local cultivators of the crop never seem able to supply. Relatively small areas were planted to this crop during the year, mainly in parts of Christ Church, St. Philip and St. Lucy. The crop germinated well but was adversely affected by heavy rains in November and December, 1951. The resulting crop reaped at the beginning of 1952 was only moderate.

Good rainfall during October and November, 1951, resulted in considerable improvement in the supply of "green" vegetables during the early part of 1952. Tomatoes, lettuce, beans, carrots and cabbage, particularly, were in good supply during this period. Except during the middle months of 1951 when vegetables were scarce, this was on the whole a favourable year for vegetable growers.

There was an excellent market for okras during the early months of 1952. As the main food crops were in short supply and corn-meal readily available at this period, prices for okras were maintained at a high level, being as high as 60 cents per 100 by the end of March.

Pests and Diseases. No major pests or diseases were recorded during the year. Pests causing minor damage included cabbage white butterflies, scale insects, green leaf hoppers, army worms and, in the wetter districts, slugs. Cultivators are becoming alive to the importance of practising proper crop rotations as a means of checking the spread of bacterial black rot in cabbage and related crops with the result that this disease has been slightly less widespread in its incidence.

Peasant Livestock and Animal Husbandry. An outbreak of fowl typhoid occurred during the period June to September, 1951. Several head of poultry were lost, especially in the parish of St. Lucy. The disease was kept under control by the prompt and effective action of the Veterinary Officer, assisted by the extension staff.

The price of balanced animal feed was increased in December, 1951, from $6.12 to $8.08 per bag, and again in February 1952 to $9.80 per bag. For a brief period in April, 1951, concentrated feed was in short supply.

The Peasants' Loan Bank. The Peasants' Loan Bank continues to play its part in providing short and medium term credit for small land owners. The success of the year's work is illustrated by the following statement prepared by the Manager of the Bank.

TABLE II.

Statement on Loans made during the Year.

	1949-50 (Nos.)	1950-51 (Nos.)	1951-52 (Nos.)
Number of loans granted during the financial year 1st. June to 31st. May ..	515	582	672
Short term loan accounts opened during the previous financial year (for cultivation, manures, taxes) and still outstanding during current financial year ..	49	55	149
Long term loan accounts opened during the previous financial years (for repayment of Mortgages, Purchase of Livestock and Irrigation) and still outstanding during current financial year..	308	255	347
	872	892	1,168
Less extensions of loans included in (1) above	7	7	68
Total number of accounts on books during the financial year	865	885	1,100
Amount of loans advanced .. $	35,603.00	42,180.00	56,822.00

Peasants' Annual Competitions. Two competitions open to peasants and held in connection with the Annual Agricultural and Industrial Exhibition took place as usual during the year. These were the Peasant Gardens Competition and the Peasant Holdings Competition. Judges were the Plant Diseases Inspector and the Acting Senior Peasant Agricultural Instructor, assisted by other members of the extension staff. Forty-one vegetable gardens and 40 peasant holdings were entered for these competitions, as compared with 38 and 27, respectively in 1950—51. A commendably high standard was attained by a large number of the entries.

B. The Work of the Department's Peasant Agricultural Extension Services

Staff. The staff continued throughout the year without the services of a Deputy Director of Agriculture, the officer formerly in charge of the extension services of the Department. The Senior Peasant Agricultural Instructor who has been responsible, since December 1949, for co-ordinating the work of the extension staff was promoted to the post of Co-operative Officer in September, 1951. He has continued since to act as Senior Peasant Agricultural Instructor, in addition to his duties as Co-operative Officer. In the circumstances, it has not been possible to achieve the desired progress with extension work.

Some changes took place in the distribution of the staff during the year. Messrs. A. Yard and V. F. Gay were transferred from their positions as Instructors-in-charge of Stations and placed on purely district work. In consequence, Messrs. E. S. Brathwaite and F. M. Cummins, formerly on extension work only, assumed charge of District Stations. Mr. A. J. Bellamy was transferred from District C. 4 to District F. 3. Mr. E. L. Murray was confirmed

in his appointment as a Peasant Agricultural Instructor with effect from 1st April, 1951. The number of Instructors' districts was then increased from 15 to 16.

The Peasant Agricultural Extension Staff on 31st March, 1952, consisted of an acting Senior Peasant Agricultural Instructor and 16 Peasant Agricultural Instructors.

Visits to Peasant Holdings. During the year the Peasant Agricultural Instructors paid 7,004 visits to peasant holdings, as compared with 8,442 in 1950—51. The increase in the number of Instructors' districts has led to a further reduction in the size of some of the individual districts, especially those of Instructors in charge of District Stations. This has resulted in a closer liaison between the Department and the peasant.

School Gardens. One hundred and ninety-one visits were paid to school gardens, as compared with 188 last year. It is pleasing to record that despite such handicaps as inadequate water supply, absence of suitable enclosures and insufficient tools and equipment from which some school gardens suffer, teachers generally are co-operating in carrying out the instructions of the extension staff and maintaining vegetable gardens of good standard.

The annual School Gardens Competition took place as usual. Judges were the Plant Diseases Inspector and the acting Senior Peasant Agricultural Instructor. There were 48 entries, as against 44 last year. The usually high standard was maintained.

Co-operation. This column has not appeared in the Department's Annual Report since 1948—49. Up to that time Co-operative legislation had not been enacted and the only attempt at co-operative action was by the so-called Fertiliser Groups. As indicated in the 1948—49 Annual Report, most of these groups were loosely formed and showed little or no chance of further development. Only one of these has since developed into a properly organised and functioning co-operative society.

A comprehensive Co-operative Societies Act was passed by the Legislature in November, 1949, and proclaimed by the Governor on 22nd May, 1951. In June, 1951, the Director of Agriculture was appointed temporary Registrar of Co-operative Societies. Mr. J. R. Cave in September, 1950, relinquished the post of Co-operative Officer to which he had been seconded in 1944. He was succeeded by Mr. C. A. E. Beckles, Senior Peasant Agricultural Instructor, who was appointed Co-operative Officer in September, 1951.

During November—December, 1951, the newly appointed Co-operative Officer proceeded on a study tour of British Guiana and Trinidad. The tour lasted one month—three weeks in British Guiana and one in Trinidad—and was arranged in order to give this officer an opportunity of studying the development of the Co-operative Movement and the method of operation of the various types of societies in the two colonies. The tour was interesting and instructive and revealed that considerable progress along specific lines of co-operative development had been achieved in the respective areas.

From the beginning of 1952 interest was being developed in the formation of co-operative societies, primarily for marketing peasants' canes. This interest arose directly as a result of a Domestic Sugar Agreement which provided for an additional price, above the basic price, to be paid co-operative societies of peasants supplying canes in excess of 500 tons to any factory. This prospect of obtaining an extra price for their canes stimulated peasants in various parts of the island to become organised into co-operative societies.

By the end of March, 1952, three of those societies were in process of formation and showed signs of developing into well organised registered societies.

Interest was also being shown in the establishment of Savings Societies. One of the first of these to become organised was among the members of the Leeward Young Farmers' Club. There was also some action in connection with the formation of a Consumers' Society.

By the end of March, 1952, applications for registration of three societies under the recently proclaimed Co-operative Societies Act were receiving consideration. It is expected that when the staff of the Department attains full strength, it will be possible to make greater progress in the promotion and registration of co-operative societies along lines best suited to the needs of peasant and other communities.

Youth Work. The Leeward Young Farmers' Club which has been functioning since 1949 began the study of co-operative principles and practices under the Co-operative Officer during the year. The Club proposes to form a Savings Society as a further branch of its activities. A Domestic Science class under Mrs. G. A. Ramsay was also started among the female section of the club. To maintain enthusiasm among these adolescents in agriculture and other rural pursuits calls for a considerable amount of initiative and organising ability on the part of the extension staff whose work in this connection must be guided and co-ordinated at high level. Mainly on account of this, no further efforts at organising other Young Farmers' Clubs have been made. Progress in this direction must await the appointment of senior staff.

Soil Conservation and Cultivation. There was a drop in the number of soil conservation projects carried out by the Peasant Agricultural Instructors on peasant holdings. This may be traced to three factors. First, because the yields of sugar cane reaped in 1951 were good and the rainfall satisfactory, heavy ratooning was the rule and comparatively little land was thrown out for cultivation. Secondly, the usual difficulty in getting labour to do this type of work was greatly increased as a result of the prolonged reaping season. Thirdly, owing to the shortening of the "cultivation season", peasants were only too glad to have their land cultivated as and when they could. In the circumstances it was generally impossible for peasants to arrange for contour cultivation of their land under the supervision of the extension staff. Nevertheless, 12 soil conservation projects were carried out during the year, as compared with 40 last year. This does not include a large number of peasants who were induced as a compromise to cut contour furrows at intervals through fields cultivated on the cane-hole system.

In order to obtain the initial reaction of small cultivators to a government proposal to provide motor tractors for the cultivation of peasant holdings, a survey was conducted by the extension staff during the period March —April, 1951. The results of the survey were eminently satisfactory; over 80 percent of the 1,600 peasants interviewed indicating their willingness to use such equipment if it were made available.

C. The District Agricultural Stations.

The work on the six District Agricultural Stations was maintained along similar lines to those of last year. Useful information continues to be collected in connection with the peasant investigational units at The Home, Sayes Court and Jerusalem Stations. However, one factor tending to limit the

value of the results of the investigations at The Home and Sayes Court has been the difficulty in obtaining sufficient water for irrigation. The inadequacies of the irrigation systems at these two stations were emphasised during the prolonged dry period at the beginning of 1952. This aspect of the irrigation units on the Stations is referred to later in this Report. It is hoped that with the provision of improved irrigation facilities, more reliable information with respect to the peasant investigational units on these Stations will be available.

The Stud Centres. Peasants continue to make good use of the stud services rendered at the District Stations. The average number of stud animals kept on the stations was increased during the year, although by 31st March, 1952, the general establishment was practically the same as in March, 1951. This is explained by the fact that, mainly owing to overwork, some of the bulls especially, having prematurely outgrown their period of useful service, had to be sold for slaughter and could not immediately be replaced. It appears that serious consideration will have to be given to the introduction of artificial insemination as a means of remedying this situation and reducing the high cost of maintaining the stud centres. The total number of services of all kinds at the stations for the year, not including free return services, was 4,517, as compared with 4,513 in 1950–51. In spite of the considerable increase in the cost of maintaining the stud establishment, the service fees remained the same, namely, bulls 72 cents, boars 48 cents and bucks and rams 18 cents.

TABLE III.

Number of Sires standing at Stud Centres at 31st March, 1952.

Station	Bulls	Buck Goats	Ram Sheep	Boars	Total
The Home	4	2	1	2	9
Sayes Court	1	2	1	3	7
Groves	4	3	2	2	11
Jerusalem	3	3	1	2	9
Haggatts	2	2	1	1	6
Bullen	2	2	1	1	6
Total	16	14	7	11	48

The stud animals comprised the following breeds:—Grade Guernsey and Holstein bulls, British Alpine and Saanen buck goats, Black Belly and Wiltshire Horn ram sheep and Berkshire and Large Black boars.

TABLE IV.

Number of Services paid for during the Year ending 31st March, 1952

Station	Bulls	Buck Goats	Ram Sheep	Boars	Total
The Home	393	194	134	265	986
Sayes Court	86	124	87	242	539
Groves	294	235	170	138	837
Jerusalem	441	265	44	119	869
Haggatts	267	202	118	50	637
Bullen	195	228	81	145	649
Total	1,676	1,248	634	959	4,517

The Financial Returns of the Stud Services. Table V, below, shows the extent to which the stud establishment at the Stations was subsidized during the year. The heavy increase in expenditure—$14,370.40 this year as compared with $10,488.39 in 1950–51—resulted mainly from three causes, namely (i) the substantial increases in the cost of balanced animal feed, (ii) an increase in the average number of stud animals, particularly bulls, kept at the Stations, and (iii) general increases in the cost of labour. The Table shows totals of cash and non-cash items. The latter includes, as usual, revenue from pen manure produced by the stud animals and expenditure on green fodder and other feeding-stuffs grown on the Stations and fed to the livestock.

TABLE V.

Statement of Revenue and Expenditure on Stud Animals for 1951–52

Items	The Home	Sayes Court	Groves	Jerusalem	Haggatts	Bullen	Total
Expenditure ..	2,675.84	1,356.39	3,640.58	2,397.64	2,644.75	1,655.20	14,370.40
Revenue ..	479.78	259.04	583.02	479.94	293.36	352.05	2,447.19
Difference	2,196.06	1,097.35	3,057.56	1,917.70	2,351.39	1,303.15	11,923.21

Breeding Sows. The policy of maintaining breeding sows on the Stations for producing young pigs for sale to peasants was continued. The demand for these young pigs continues to be heavier than the Stations can supply with their limited facilities for pig keeping. At the same time, the increased cost of producing these young pigs without a corresponding increase in the controlled price at which they were sold pushed up the cost of an already heavily subsidized service.

The Demonstration side of the District Stations. The demonstration side of the work on the Stations continued to be concentrated, as far as crops are concerned, on the arable land not covered by the peasant investigational units. This area is divided into fields on which are demonstrated suitable rotations, based on sugar cane as the main cash crop. The area also included a vegetable garden, fodder plots and, in the case of four of the Stations, a small banana plot as well.

Financial Returns of the Demonstration side of the Stations. As usual, careful cost accounts were kept of all work on the Stations. These accounts included cash as well as non-cash entries. Non-cash items comprise fodder and feeding-stuffs, such as, yams, sweet potatoes and cane tops grown on the Stations and fed to the livestock, and pen manure produced on the Stations and applied to the crops. The revenue and expenditure for the demonstration side of the six Stations together are summarised in the following statement:—

	Cash	Non-Cash	Total
Expenditure ..	23,045.28	4,903.41	27,948.69
Revenue	16,035.84	6,398.71	22,434.55

Financial Statement for the Stations as a whole. The financial statement for the Stations as a whole which appears in summary below takes into account cash revenue and expenditure in connection with all branches of the work carried out on the Stations. These various branches may be classified for convenience under the following heads:—

(a) Demonstration or commercial, referred to above.

(b) Investigational or experimental, for example, the peasant investigational units.

(c) Subsidized activities, such as, stud services and breeding sows.

(d) Capital, including major repairs to buildings, roads, etc.

Statement of Cash Revenue and Expenditure for the year 1st July, 1951 to 30th June, 1952

Expenditure:

Total Expenditure for the six Stations	$47,336.90

Revenue:

Actual receipts brought to account for the six Stations	$22,723.59

SECTION II.

SUGAR CANE BREEDING AND SEEDLING TESTING

By

B.deL. Inniss

Botanist, B.W.I. Central Sugar Cane Breeding Station.

Sugar Cane Breeding—B.53' and B.54' Series.

Sugar cane breeding was carried out at Groves Agricultural Station from October 1951 to January 1952. Arrowing was very free and very concentrated, so that the lanterns available could not be used more than once. One hundred and one crosses were made as well as seventeen selfs and line breeding crosses for the Cytogeneticist. It is estimated that 106,000 seedlings germinated; 30,528 were potted and 21,649 were planted in the B.53' Short Season First Year Seedling Trial and the Nursery for the B.54' Series. In addition, seed of twenty-one crosses, a high proportion of the seedlings of which should be resistant to mosiac disease, was sent to Jamaica.

Details of the crosses made and of the seedlings raised, potted and planted out are available in the Annual Report of the B.W.I. Central Sugar Cane Breeding Station.

Reaping of the First Year Seedling Trials—B.52' Series.

Three hundred and ninety-six seedlings were selected from the First Year Seedling Trials of the above series, details of which are tabulated in the above mentioned Report. These seedlings were planted in multiplication plots at Codrington Station.

Seedlings of the B.51' Series.

These were multiplied and subjected to further selection at Codrington They were planted in Second Year Seedling Trials at Codrington (2 trials) and in duplicate trials at the high rainfall stations, Hothersal and Todds. In addition, the Short Season Selections were planted during May in a Short Season Second Year Trial at Codrington.

Seedlings of the B.50 Series.

These were cut as plant canes in the Second Year Seedling Trials during the past crop season, at the low rainfall station, Codrington (2 trials) and at the high rainfall stations, Andrews and Pool. Thirty-nine selections were made, of which four are for the breeding plots at Groves only. The most promising will be tested further in Barbados, and in October, Colonies which contribute to the Station will receive selected consignments. One seedling was selected from the Short Season Trial in addition to those which were selected from the normal trials, and this will be included in the British Guiana selection. Particulars of the performance of the selected seedlings are given in the Annual Report of the Station.

Seedlings of the B.49' Series.

These were cut as ratoons in the Second Year Seedling Trials at Henley and Clifton Hall during the past crop season. One seedling was selected on its ratoon performance, and will be included along with the seedlings of the B.50' Series. Selected seedlings of this series were planted in Third Year Seedling Trials in November, 1951.

Seedlings of the B.48' Series.

Seedlings of this series were cut as plant canes in the Third Year Seedling Trials during the past crop. Only one seedling, B.48392, gave cane yields exceeding those given by the standard commercial varieties, B.37161 and B.4098, and the juice quality of this variety was so poor that it cannot be considered for commercial cultivation.

Seedlings of the B.47' Series.

Seedlings of this series were cut as first ratoons in the Third Year Seedling Trials. Rat and weevil borer damage in nearly all of the trials was very severe, and helped to confuse the results. Another factor which operated in this direction was the damage done to some of the plots in removing the canes during the very wet 1951 crop season. B.4744, which was outstanding as a plant cane, again led the way in the high rainfall areas and was also quite good in the low and intermediate rainfall areas. B.47419 ratooned very well indeed, but suffered severely in some trials from damage by rats and weevil borer. It would appear that both of these varieties are superior to the standard varieties, B.37161 and B.4098 under the conditions of these trials. B.4738 gave excellent yields of ratoon cane in the low and intermediate rainfall areas, and has quite a good juice. However, it arrows too freely to be at its best in the high rainfall areas. B.4747 also gave very good yields of ratoon cane, but the juice quality is not so good. B.47258 and B.47380 gave reasonably good yields of ratoon cane in the high and intermediate rainfall areas, and had exceptionally good juices. B.47314 also gave very good yields of ratoon cane in all rainfall categories, and has a very good juice, but the canes are inclined to be thin and have a very high fibre content. Planting material of B.4738 and B.47380 has been brought back to Codrington, and these varieties will be tested further. Planting material of B.4744 and B.47419 was distributed during November, 1951.

Seedlings of the B.45' and B.46' Series.

These seedlings were cut as second ratoons in the Third Year Seedling Trials. Only two of these trials reached the second ratoon stage; one in the intermediate and one in the high rainfall area. B.45151 gave excellent yields of second ratoon cane, and will be distributed to planters during the coming planting season. The canes are thin, very vigorous and have an excellent juice. The variety is recommended for trial in the high rainfall areas only, where it should be useful during the early part of the crop season. B.46364 also gave excellent yields of ratoon cane particularly in the high rainfall areas. It is a thick red cane which arrows very sparingly, and drops its trash very readily. It has quite a good juice and is a very powerful ratooner. Planting material of this variety has been brought back to Codrington, and the variety will be tested further.

Details of the above trials are available in the Annual Report of the B.W.I. Central Sugar Cane Breeding Station.

SECTION III

BOTANY

The propagation and distribution of ornamental plants was continued during the year. The number of plants distributed is given in Table I.

TABLE I

Year	Number of plants distributed
1950-1951	11,615
1951-1952	5,732

Distribution of Vegetable Seed from the Department's Office

This distribution aims at encouraging the purchase of vegetable varieties which are known to be suited to local conditions. The Department purchases these seeds from reliable firms and sells them in small quantities at cost. The quantities distributed are given in Table II.

TABLE II

Seed	Variety	Amount — lb.	
		1950-51	1951-52
Beans	Bountiful	7,269	13,026
„	Kentucky Wonder	22	115
„ , Lima ..	Fordhook	25	100
„ „ ..	Ideal	65	100
„ „ ..	Early Giant	9	25
„ „ ..	Tender Green	—	5
„ „ ..	Super Green	—	5
„ „ ..	Plentiful	—	5
„ „ ..	Henderson Stringless ..	—	5
„ „ ..	Top Crop	—	25
„ „ ..	Landreth's Stringless ..	—	20
Beet	Detroit Dark Red	140	236
„	Early Blood Turnip ..	10	70
„	Early Egyptian	30	15
„	Lutz Green-leaf	—	10
Cabbage ..	Hastings Sure Crop	14	18
„	Danish Ball-head	19	3½
„	Late Flat Dutch	20	3½
„	Wakefield Charleston ..	19	24
„	Early Jersey Wakefield ..	—	11½
„	Resistant Golden Acre ..	—	11½
„	Succession	—	7½
Cantaloupe ..	P.M.R. No. 45	1¼	2¼
Carrot	Chantenay	24	55
„	Danvers	157	155
„	Oxheart	208	215
Cauliflower ..	Sutton's Early Market ..	—	2
„ ..	Sutton's Early Patna ..	12¼	8
Cucumber ..	Henderson	3	—
„ ..	Marketer	1	¼

Seed	Variety	Amount — lb.	
		1950—51	1951-52
Cucumber ..	Long Green	½	—
„ ..	Long Fellow	¼	—
„ ..	A. & C.	—	6
„ ..	Cool and Crisp	—	6
Egg Plant ..	Black Beauty	1¾	1⅝
Kohl Rabi ..	Extra Early White Vienna ..	2¾	3½
Lettuce	Mignonette	65	68
„	Black Seeded Simpson ..	7½	5
„	Bibb	—	5½
„	Grand Rapids	—	½
Okra	Early Prolific	¾	2½
„	Dwarf Prolific	—	8
Onion	Crystal White Wax	—	½
„	Southport Red Globe ..	—	3
„	Red Bermuda	—	3½
Parsley	Emerald	16	16
Pea	Laxton's Progress	9	38
„	Early Delicious	9	—
Pepper	Ruby King	¾	1⅛
„	Early Wonder	—	¾
Radish	Scarlet Globe	4¼	15
Squash	Delicata	1¼	—
„	White Bunch-Scalloped ..	4	10½
„	Early Prolific Straightneck	—	¼
Swiss Chard ..	Lucullus	3	3
Tomato	Bounty	15	25
„	Marglobe	—	57
„	Early Chatham	5	—
„	Extra Early Prolific ..	26¼	—
„	Pritchard	—	25
„	Bonny Best	—	35
Turnip	Purple Top White Globe ..	3	3¼
	Total	8,217	14,626¼

(a) *Citrus.* Eight types of citrus trees were propagated and distributed, i.e. lime, orange, grapefruit, shaddock, lemon, mandarin, pomelo and citron. The scion material consisted chiefly of budwood from local vigorous seedling trees and, to a less extent, of commercial varieties imported from Trinidad and established in the orchard at Codrington Experiment Station. The stock used was sour orange grown from seed imported from Trinidad.

During the year, a total of six hundred and twenty-five budded citrus plants were distributed at a price of six cents to peasants and twenty-five cents to others. (See Table III).

(b) *Dwarf Coconuts.* Coconuts of the 'dwarf' variety which come into bearing in three to five years, were imported from St. Lucia and distributed One thousand three hundred and fifty-four hatched nuts were distributed.

TABLE III

Species	Varieties	Total Number of plants delivered	
		1950-51	1951-52
Citrus:			
Citron ..	Trinidad	2	6
Grapefruit ..	Foster, Duncan, Marsh, Walters, Claybury Nos. 1 & 2	207	68
Lemon ..	Claybury, Frere Pilgrim ..	35	21
Lime	Dover, Claybury, Lisbon ..	490	213
Mandarin ..	Dancy, Claybury, Nos. 1, 2 & 3	35	40
Orange ..	Tardiff, Parson Brown, Navel, Ruby, Pineapple, Claybury, Nos. 1, 2 & 3, Bernardo	339	196
Shaddock ..	Kinch, Claybury Nos. 1 & 2	20	40
Pomelo ..	Codrington	18	41
		1,146	625
Avocado Pear ..	Selected seedlings	132	116
Miscellaneous:			
Breadfruit ..		43	40
Breadnut ..		2	4
B'dos Cherry		13	36
Fig		9	15
Guava ..		79	49
Grape ..		20	13
Golden Apple		44	12
Genip ..		2	1
Pawpaw ..		75	36
Sugar Apple		13	6
Soursop ..		—	4
Tamarind ..		2	—
Water Lemon		7	6
Dwarf Cocoanuts ..	Hatched nuts	1,804	1,354
	Total	3,391	2,317

Afforestation

Distribution of Trees. Twenty one thousand four hundred and thirteen casuarina and mahogany trees in pots were distributed free of cost during the year.

SECTION IV

CULTIVATION

By

W. H. C. KNOWLES

Cultivation Officer

The writer assumed duty as Cultivation Officer in February 1951. The duties of this post as set out in the 1950—1951 Annual Report were "to be determined from time to time in accordance with the objective of attaining the highest practicable level of efficiency in sugar cane production through the practice of the most suitable methods of cultivation applicable in relation to recognized soil groups, the need for soil conservation measures and the effective use of irrigation water and weedicides".

It has not been possible for the Cultivation Officer to reap experiments established in connection with the attainment of the above aims, and hence no experimental results can be presented in this report. The following investigational and extension work has, however, been undertaken during the year.

A. Investigation

(1) Improved soil management under the cane-hole system

Three trials have been laid down to test the effect of close ploughing as compared with the more usual "2 cuts to the bank" method. The effect of siting the cane-holes within the ploughed area as against the normal method of digging them in the "hard" is also being investigated.

(2) Management of Group IV soils

An experiment has been laid down to test the effects of furrowing as compared with flat planting and planting in cane-holes on a cambered bed layout. In the same trial the effect of a mulch of sour grass is being investigated. A simple A.B.B.A. type comparison of furrowing versus non-furrowing in a camber bedded group IV soil has been established at the Pine Plantation.

(3) Bagasse Application

In co-operation with the Agricultural Chemist, two trials to test the effect of bagasse application have been established. One trial has been sited on a heavy black coralline soil and the other on a free-draining red coralline soil. The bagasse has been applied as a mulch over the whole surface of the plot and to the cane-hole in the first trial. In the second it has been applied in the same way but subsequently forked into the soil. In the first trial the effect of splitting the normal nitrogenous fertilizer application has been tried.

(4) Weed Control

Shortage of staff has led to a curtailment in investigational work on methods of weed control. It is hoped that the staff situation will improve and that experiments involving the use of the new weedicides together with an intensive study of Barbados canefield weeds can be undertaken.

(5) Changes in Productivity consequent on improved Soil Management.

The Cultivation Officer has devoted considerable time to an attempt to measure changes in productivity which result from improved methods of cultivation etc. As it is extremely difficult (in many cases impossible) to compare different cultivation systems by means of small plot trials of formal design, an attempt must be made to arrive at the productivity of a given field before and after the use of the new technique.

The method adopted is to work out the Productivity Index of the field in question before and after treatment. This is done by comparing the yield of the given field with that obtained from all the plantations in the same rainfall group for equivalent years, varieties and cycles. Expressed as a percentage of the latter the field yield for a given year represents its Productivity Index. Although the method is far from perfect, it is felt that it will give a reasonably reliable measure of changes in productivity. Naturally, the more yield data that can be obtained, the more accurate will be the method, and hence it can only be successfully applied to plantations which have kept accurate field records for a number of years. As an example, the following is taken direct from the field notebook used in this work.

Estate	Field	Year	Variety	Cycle	Field T.C.A.	Island T.C.A.	Productivity Index	Remarks
"X"	Tamarind Tree	1941	B.3439	Plants	26.09	27.82	93.78	Cane-hole system
		1942	B.3439	1st Ratoons	19.71	23.43	84.12	Cane-hole system
		1943	—	—	—	—	—	Field in preparation
		1944	B.37161	Plants	28.07	29.88	93.94	Cane-hole system
		1945	B.37161	1st Ratoons	27.06	30.93	87.49	Cane-hole system
		1946	—	—	—	—	—	Field in preparation
		1947	B.37161	Plants	27.17	27.97	97.14	Cane-hole system
		1948	B.37161	1st Ratoons	27.06	30.93	87.49	Cane-hole system
		1949	—		—	—	—	Field in preparation
		1950	B.4098	Plants	37.18	35.51	104.70	Field in contour furro
		1951	B.4098	1st Ratoons	37.89	37.00	102.41	Field in contour furro

It will be noted that the above example shows Tamarind Tree to be a consistently below average yielding field prior to the 1950 crop. For that year's crop the field layout had been changed from caneholes to contour furrows and the field yield was slightly above the Island's average as it is in 1951. It must be admitted, however, that from the large number of fields so examined, Tamarind Tree is unusual in having a reasonably consistent productivity index under a given system of management. As a rule considerable fluctuations are found and as a result it is not possible at this stage to present figures indicative of any definite trend.

(6) Soil moisture Studies in relation to Soil Groups and Method of cultivation.

In an attempt to assess the effect of different soil groups and different cultivation methods upon the soil moisture, a series of Nylon Resistance Blocks were buried in selected fields at the Pine Plantation and readings have been taken for these blocks for a period of approximately 8 months. It is hoped to be able to continue readings throughout the crop cycle so that a complete picture will be obtained. The blocks were sited as follows:—

Soil Group	Cultivation System	No. of blocks	Remarks
IV	Camber beds	8	Blocks sited at 6″ and 12″ depth. Two blocks have become defective.
IV	Cane hole	6	Blocks sited as above.
IV	Camber beds furrowed and non-furrowed	6	Blocks buried in furrows to be compared with those buried in the row in non-furrowed beds.
II	Contour furrows	8	Four blocks buried in ridge and 4 in furrow. Two of each in fallow and two in land under cane.
II	Contour furrows and Cane holes	6 6	Blocks buried in same field under contrasting systems of soil management.

The efficiency of the Nylon Blocks under local conditions has not yet been fully tested and the indications are that certain blocks become defective after perhaps two to three months in the soil, while a few never appear to achieve equilibrium and give reliable readings. Nevertheless, it is hoped that the method can be perfected as a quick and convenient way in which to study soil moisture relationships.

(7) Pot Studies with nylon blocks.

To be effective as a means of irrigation control, nylon block readings have to be correlated with the moisture content of the soil and this in turn has to be interpreted in regard to the availability of that moisture to the crop. In order to make these relationships reliable, laboratory determinations of moisture content and nylon block readings should be made for each field site, and in addition wilting point and field capacity determinations must be carried out.

In the hope of developing a method of correlating the nylon block reading directly with the soil plant water relationship, a series of pot experiments were started in which the growth rate of maize was studied in relation to nylon block readings. Sufficient data has not so far been obtained to permit of the publishing of results, but the method appears promising and interesting indications have been observed.

(8) Foliar Diagnosis.

The Cultivation Officer has assisted the Agricultural Chemist in the campaign of leaf sampling for foliar diagnosis, throughout the year.

B. Advisory and Extension.

Soil Management.

Considerable attention has been devoted throughout the year to advisory work on soil management. The Cultivation Officer has visited seventeen plantations at the request of their managers or attorneys to give advice on soil management problems. In the majority of cases new cultivation layouts for the fields in question were suggested and their establishment supervised. A total of four fields (approximately 30 acres) were laid out in key contours with contour furrowing on a one per cent. grade. Key contours only were laid

down in 6 fields (totalling 42 acres) while a camber bed layout was suggested and established in 2 cases. No satisfactory test was made of the four per cent. graded contour "herring bone" system for use on the sloping group IV's of the Scotland District, but a number of plantations have shown interest in trying this experimental system and it is hoped that several fields may be established in it in 1952. Nevertheless, in spite of the progress made, it must be said that on the whole, planters do not avail themselves of the services of the Cultivation Officer to the extent that might have been anticipated. It is hoped that the accumulation of yield figures and calculation of the productivity indices, will as time goes by, permit of a clear picture of the benefits of the new systems being presented to planters and so encouraging a more favourable response.

In addition to work on the sugar estates, the Cultivation Officer has from time to time given advice to peasant proprietors on cultivation problems and has assisted in the laying out of improved cultivation systems on the District Agricultural Stations.

C. Pine Plantation.

The Pine Plantation, which is worked by the Department of Agriculture in connection with the Central Livestock Station, comprises over 180 acres of arable land and contains a variety of soil types. Soils range in the Turner classification from flat heavy group IV's to sloping light groups II's and III's. The Pine thus presents an ideal opportunity for testing under controlled conditions the improved systems of soil management recommended by the Department on an estate scale. At the same time field scale irrigation of sugar cane can be investigated, and an attempt made to see whether the keeping of a considerable number of livestock is compatible with sugar cane estate agriculture in Barbados.

Throughout the year, the Cultivation Officer has devoted considerable time to the agricultural problems of the Pine. The following are the principal projects being undertaken.

(1) A general plan for future cultivation of the Pine has been drawn up. Cultivation systems have been correlated with soil group, but an attempt has been made to keep a number of "control" fields adjacent to fields into which the new systems are being introduced. These control fields will continue to be cultivated by traditional methods.

(2) The productivity, both of the Pine plantation as a whole and of the individual fields, has been gone into carefully. Productivity indices have been worked out for individual field yields for all the years in which records are available. The productivity of the Pine as a whole has been compared both with the yields for the entire intermediate rainfall group and for the last three years, with a group of plantations which it is felt represent conditions of soil and rainfall similar to those obtaining at the Pine. It is hoped by this means to study the responses of individual fields to the new cultivation techniques and at the same time to see whether the general productivity of the whole estate tends to rise or fall under a system of management which makes possible the keeping of large numbers of livestock.

(3) The problems of fodder production are being investigated. This project includes the management of the permanent fodder grass pastures and an experiment is being established in which the effects of different rates of sub-soil ploughing and of organic manures are being compared. In addition, the most efficient use of the cane land between crops for the production of guinea and indian corn is being studied. The attendant problems of weed control and cultivation in preparation land is being investigated.

(4) The Cultivation Officer has assumed responsibility for the laying out of all fields which are to be put into new cultivation systems. In all cases this work has been under his personal supervision.

SECTION V.

IRRIGATION

By

A. D. Herbert
Irrigation Officer.

1. Small Holdings

During the year under review, the irrigation of small holdings continued to absorb a considerable portion of the Irrigation Officer's time. Applications were dealt with; these included requests for advice on—

(a) whether water would be available at a particular site;

(b) what depth it would be necessary to dig for water;

(c) what would be the most suitable type of pumping equipment;

(d) the most suitable type of water distribution system.

The increasing cost of irrigation equipment had the effect of reducing the number of persons that were able to afford irrigation units even with the aid of the Colonial Development and Welfare Grant. When Colonial Development and Welfare assistance was first planned for peasant irrigation, costs were about one-third of what they are at present. In order to offset this increase to a certain degree, it has been arranged to increase the amount of the free grant to approved peasants for irrigation purposes from $480 to $720.

The relatively high cost of windmills has made it convenient, in many cases, to use diesel driven pumping plant in preference. Whilst operating costs are higher, a diesel pumping plant of approximately the same cost as a windmill, delivers three to four times the volume of water, and is independent of the vagaries of the wind.

2. Agricultural Stations.

General supervision was given to the irrigation activities on the Agricultural Stations.

Codrington. The old pumping equipment has been replaced with a modern and efficient electric submersible pump which delivers 4,000 gallons of water per hour.

The irrigation lines have been kept in repair, and new permanent overhead lines added.

Central Livestock Station. Additional four inch mains were laid under the public road to make the irrigation of 'Gap Field' possible.

Additional five inch aluminium mains were added to bring increased acreage within the reach of the pumping plant.

A separate system of mobile piping was laid in 'Long Bottom Field' to irrigate the permanent fodder plots there. This has caused a considerable saving in labour and transport and given more efficient coverage to that area.

A restricted supply of electric current has placed a very severe handicap on irrigation at this Station. It has made it impossible to irrigate the increased area contemplated during this year, and has caused frequent delays, cessations and actual reductions in the flow of water to the fields.

A pipe line to convey liquid manure from the livestock pens to the permanent fodder grass field was laid and is working satisfactorily. This enables use to be made of valuable manure which previously was run into suck wells.

The Water main intended to deliver water from the pumping plant to the Central Livestock Station buildings, has been tested and extended, pending the provision of funds for its completion.

"The Home". The gasolene booster pump, which was very expensive to operate, has been replaced with a more efficient diesel unit.

A survey was made of the irrigation system and programme, and recommendations made for the more effective use of the unit. Additional permanent overhead irrigation lines have been installed. The existing irrigation equipment is not adequate for carrying out the programme of investigational work.

"Sayes Court." A survey was made of the irrigation system. As a result, certain minor additions were made to the equipment, and recommendations were made for the more effective use of the unit. Additional permanent overhead irrigation lines have been installed.

"Bullen". The pumping system at this Station is inadequate. Plans and Estimates have been made for an adequate unit.

"Jerusalem". The pumping unit as this Station is too small to supply the needs of the sandy soil in the area. Plans and estimates have been prepared for an adequate unit.

The well, which is in the stream water area, continues to silt up and may have to be abandoned.

"Haggatts". The test well has been abandoned due to the very small supply of water obtained from it. The possibilities of pumping water from the adjacent river are under consideration.

Mental Hospital Farm. Plans and estimates were prepared for an irrigation system to be used on the Mental Hospital Farm in conjunction with the dairy.

Advice and assistance was given in the erection of an overhead irrigation system for the vegetable garden at the Farm.

3. Underground Water Control Act, 1951.

Considerable preparatory work was done in connection with the Underground Water Control Act which was passed by the Legislature during November, 1951.

Estimates have been obtained for generating plant and pumps to test exploratory and other wells.

4. Investigational.

Certain preliminary investigational work is being carried out at the Pine Plantation to determine—

(a) the frequency of application of irrigation water;

(b) the optimum quantity of water for each application.

Equipment for indicating soil moisture has been tested and proven as a preliminary step to laying down experimental irrigation plots. This equipment is being tested on soils of groups II, IVa and IVc.

SECTION VI

CHEMISTRY

BY

J. B. D. ROBINSON

Chemist

Introduction.

With the appointment of a Government Analyst in October 1951, it was possible to devote full time to the duties of Agricultural Chemist. On the whole, satisfactory progress has been made in the several investigations which have been under active consideration and the results obtained are summarised under the appropriate sections of this report together with a note on advisory activities.

Table of samples received for Agricultural Analysis

Type of Sample	Particulars	No. Received
Soil	Advisory work	23
Soil	Soil fertility investigation	13
Soil	Irrigation water control investigation	79
Fodders	Pine perennial fodder trial	33
Concentrates ..	Advisory work	18
Sugar Cane Leaf ..	Manurial trial investigation ..	330
Milk	Routine samples from Central Livestock Station	345
Miscellaneous ..	Advisory and investigation	38
	Total ..	880

These samples represent approximately 4,124 individual chemical or physical determinations.

Soils.

1. Loss of volatile ammonia from sulphate of ammonia applied to a coralline soil.

In a recent paper by Martin and Chapman (1951) the results of exhaustive studies related to the loss of volatile ammonia from soils with an alkaline pH reaction after artificial nitrogenous fertilization, were published, together with a brief review of the previously published work of several other authors. In their summary they state: "A study was made of the loss of nitrogen through volatilization as ammonia from surface fertilized (alkaline) soils.... It was found that 9—51 per cent. of the nitrogen added in the form of ammonium hydroxide and 1—27 per cent. of nitrogen added as ammonium sulphate was lost. The pH of the soil was unimportant in determining the degree of loss. Below a pH value of 7.2 very little ammonia was lost from ammonium sulphate.

Increasing the amount of ammonium nitrogen applied to an alkaline soil increased the total quantity of nitrogen lost, but did not appreciably effect the percentage lost. The moisture content of the soil had little effect *except* that evaporation of water was necessary for appreciable volatilization of ammonia from the soil."

Manurial trials carried out by this Department in the past, and results from recent trials (1952 crop) have shown that the response of cane per acre to similar applications of ammonium sulphate given in January and June following planting in Novemer, is often very different, i.e., a much lower response being obtained from the earlier application. One of the possible reasons for this is the loss of volatile ammonia nitrogen from the ammonium sulphate applied to the cane in January. The weather is usually dry at this time, with occasional showers, and much wind and sun to cause soil moisture evaporation, said to be an essential for volatile ammonia soil loss. Also the pH reaction of the coralline soils is alkaline, and the rendzina type often contains large quantities of free calcium carbonate.

Some simple laboratory tests were carried out to determine whether volatile ammonia is lost from the coralline soils.

Preliminary discussion and methods.

A known weight (50 gms.) of air-dry ground soil was placed in 500 ml. conical flasks to a depth of ¼ inch in the bottom. This gave a surface area exposed of 9.6 sq. ins. Sulphate of ammonia was added in water solution, wetting the soil to 50 per cent. moisture content expressed on an oven dry soil basis, at the rate of 3 cwt./acre, i.e. .0081 gms./sq. inch ≡ 1 cwt./acre assuming general distribution. It is worthy of note here that the sulphate of ammonia was added on the assumption of general surface distribution over an acre of land. In actual practice it is applied to the banks which, on a 5ft. x 5ft lining, occupy only 5/6th of the acre area. The 3 cwt./acre dressing then becomes a concentration of roughly 3.6 cwt./acre on the basis of bank area coverage This would have an important effect on total ammonia nitrogen volatilised if, as Martin and Chapman state; "increasing the amount of ammonium nitrogen applied to an alkaline soil *increases the total quantity* of mitrogen lost, but does not appreciably effect the percentage lost."

After the addition of sulphate of ammonia and water, the flasks were immediately connected to an aeration apparatus, and as soon as all free water had penetrated into the soil, aeration was begun. The air was first passed through conc. H_2SO_4 and then through a large $CaCl_2$ tube, to remove traces of ammonia, and moisture. It then passed over the surface of the soil in the flasks and into standard H_2SO_4 to collect the ammonia volatilised. The soil was aerated each day until its was cracked and dry. The ammonia absorbed by the standard acid was determined by titration, the soil remoistened with distilled water to the predetermined value, and further aerated. This was repeated several times; a blank of soil with no sulphate of ammonia was also carried out. but not all the soil samples were tested in duplicate. All the tests were carried out at room temperature.

The soil samples, unless otherwise stated, were sterilized with $CHCL_3$ before the aeration began to avoid micro-flora complications, and to reduce the action in the soil to a purely chemical one.

Results

The results of ammonia loss from the several soils tested are given in Table I.

TABLE I.

Volatilization loss of ammonia from calcareous coralline soils.*

Soil Sample	pH	Free $CaCO_3$ content	Sulphate of ammonia added	NH_3 — nirogen lost. † (Added nitrogen lost by volatilization)							
		%	mgms.	1st drying mgms.	2nd drying mgms.	3rd drying mgms.	4th drying mgms.	5th drying mgms.	6th drying mgms.	7th drying mgms.	%
Codrington Gap B (IA) ..	8.37	7.53	232‡	1.77 (20.85)	1.46 (22.05)	1.02 (20.85)	1.09 (17.08)				9.52
Codrington Gap B (IIA)	8.37	7.53	232	1.53 (22.93)	1.12 (20.50)	0.85 (20.01)	0.75 (19.60)	Experiment lost at this stage			7.58
Codrington Gap B (IB)	8.37	7.53	232	1.52 (22.27)	1.22 (21.05)	1.29 (20.11)	0.89 (20.00)	0.82 (20.15)	0 61 (18.72)	0.82 (20.25)	12.80
Codrington Gap B (IIB)	8.37	7.53	232	1.29 (22.83)	1.16 (20.55)	1.02 (20.14)	0.89 (19.96)	0.82 (19.87)	0.61 (18.43)	0.68 (20.62)	11.53
Codrington field 2 (IC) ..	8.32	14.84	232	1.63 (19.67)	1.90 (22.55)	1.22 (19.73)	1.91 (18.62)	1.70 (21.95)	0.88 (19.66)	1.02 (19.66)	18.30
Codrington field 2 (IIC)°	8.32	14.84	232	1.63 (24.65)	0.14 (16.62)	0.07 (27.52)	0.00 (20.45)	0.00 (21.15)	discontinued		3.28
Bowmanston ..	8.39	1.09	232	2.24 (23.20)	1.90 (19.55)	1.43 (20.50)	1.22 (19.78)	1.16 (19.85)	1.16 (20.03)	1.02 (19.43)	18.06
Bowmanston° ..	8.39	1.09	232	2.31 (25.05)	1.83 (19.40)	0.82 (20.61)	0.88 (19.83)	0.75 (19.90)	0.48 (19.90)	0.48 (19.32)	13.46
Guinea ..	7.94	0.13	232	1.22 (22.55)	0.82 (12.57)	1.02 (22.68)	1.02 (24.07)	0.82 (20.05)	0.54 (20.47)	0.54 (19.78)	10.66

° Soil sample not sterilised with $CHCl_3$.

‡ 232 mgms. sulphate of ammonia = 56.08 mgms. NH_3.

+ figure in brackets in wt. of water lost by evaporation in each cycle from the soil.

* Soil adjusted to 50% moisture content expressed as % oven dry soil.

Summary

(a) It will be noted in Table I that seven drying cycles only were recorded in the majority of cases. Aeration was simply discontinued at this point, and except for the Codrington field No. 2 non-sterilized soil, none of the samples had ceased to lose volatile ammonia completely at this stage.

(b) By titration and weighing at intervals during any one complete cycle, it was confirmed that the rate of volatile ammonia loss decreased as the soil lost moisture until finally aeration produced loss in neither case. This is in agreement with results previously published.

(c) The last three soil samples in Table I (red coralline soils) were included for comparison purposes. The rate of loss of volatile ammonia nitrogen compared with the black coralline soils of higher pH reaction and free calcium carbonate content is surprising, although the total base exchange capacity of these soils is only 50 per cent of that of the black coralline samples.

(d) It is obvious from the figures in the last column of Table I that volatile ammonia nitrogen is lost from the coralline soils under conditions of soil moisture loss. It is not possible to say to exactly what extent this loss occurs from these short preliminary determinations. It appears, however, that the soil in its natural state, i.e. non-sterilized, is capable of retaining more of the ammonia nitrogen in applied sulphate of ammonia fertilizers than the sterilized sample is, under similar external conditions of micro-climate.

Further elaboration of this work is not proposed since the present practical method of applying sulphate of ammonia on the estates, i.e. with the onset of the rainy season, avoids any probability of volatile ammonia nitrogen loss.

2. Seawell soil investigation.

As described in the previous annual report (Section IV, Soils 4), samples of soil collected from Seawell area were forwarded to Dr. A. Muir at Rothamsted Experimental Station and to Mr. G. Rodrigues at Imperial College of Tropical Agriculture for X-Ray and chemical analysis, respectively. The object of this was to obtain some fundamental knowledge of the characteristic clays in these soils, and hence perhaps a better understanding of the development of the Barbados coralline soils from the original parent material.

Dr. Muir's report concerning the samples of red and grey soil sent to him is as follows:—

"From the clay mineral standpoint, there is practically no difference between the various samples. They all consist essentially of a mixture of montmorillonite and illite with small amounts of kaolinite and vermiculitic material. . . . It may be of interest to know that the dark rendzina like soils on the chalk in this country may contain mica and montmorillonite interstratified, and pockets of red material which occur locally in the chalk seem to be not unlike your material in composition."

Mr. Rodrigues examined chemically similar samples as those sent to Dr. Muir, and in his report he compared his results with previous analyses reported for samples of red and black coralline clays submitted for analysis a few years ago by Mr. F. H. B. Blackburne. Mr. Rodrigues reports as follows:—

"In Table I are presented the results of mechanical analysis and in Table II those of bulk chemical analysis of the clay fraction (2u). For comparison, in each Table are included analyses of typical red and black soils, as well as of a sample of "soil" collected by the late Dr. A. Senn

from 'a former land surface existing previous to the deposition of the coral rock.' The graph shows the dehydration curves for the five clay fractions.

The mechanical composition for all the samples is similar, except that of the black soil which, apart from having a higher content of calcium carbonate, is much higher in sand content and correspondingly lower in clay. As shown in the previous report, this sand is practically all quartz (85%).

The chemical analysis (Table II) shows the following main results:—

(1) The red clay from Seawell contains much higher amounts of free iron oxide (soluble in Tamm's reagent in sunlight) than the grey. The reverse is true for the combined (insoluble) iron oxide. There is a slight difference in total iron oxide, the grey again being the higher.

(2) Both samples show a high silica-alumina ratio. That of the red clay is approximately the same as that of the clay of the Barbados black soil, but that of the grey clay is much higher. The base exchange capacity is in accord with the silica-alumina ratio and falls in the same line as ratio of the various clay fractions examined previously.

(3) The magnesium content is about the same in the two samples, but is higher than that of any other sample of Barbados soils with the exception of the deep sample collected by Senn beneath the coral rock.

(4) The potash content is the most striking feature of all. Again, with the exception of the sample from beneath the coral, the K_2O content for all samples of clay separated from the soils was extremely low (ranging from 0.02 to 0.13 per cent.), while that of the red pocket from Seawell was 1.9 per cent. and that of the grey 0.8 per cent.

The dehydration curves also show marked differences from those of the soil clays, notably in the water lost between 400°C and 600°C as can be seen below:—

Clay	% Loss at 400°C	at 600°C	Difference
Red—Seawell	15.5	19.4	3.9
Grey—Seawell	17.6	20.9	3.3
Red Soil	7.5	15.4	7.9
Black Soil	10.9	16.9	6.0
Below coral	7.7	13.7	6.0

Conclusions.

From the above considerations it is obvious that, in the case of the material found in the pockets in the coral rock, we are dealing with a clay mineral or assemblage of clay minerals vastly different from those in the soil clays. The content of a kaolinite mineral seems to be much higher in the soil clays than in the Seawell samples, while a montmorillonite mineral seems to characterise the latter. From the relative contents of potash, it might be expected also that an *illite* mineral is fairly abundant in the Seawell clays, being much higher in the red sample than in the grey sample, while it is practically absent in the soils. In the deep sample, there seems to be some illite (if we are to judge from potash content), but its amount is relatively small.

These findings are in accord with the clay mineral analysis performed at Rothamsted of the Seawell clays. A point left unsettled, however, is the mode of occurrence of the iron 'in combination' which is considerably higher in the grey than in the red sample. It would be interesting to see how far the above conclusions for soil clays are borne out by X-ray analysis, before attempts are made to link up the different stages in the evolution of the Barbados coral soils."

TABLE I.

MECHANICAL ANALYSIS

		Coarse Sand %	Fine Sand %	Silt %	Clay %	C_aCO_3 %	Total %
(A)	*Seawell Samples*						
	Red ..	0.3	2.3	9.5	76.8	2.8	91.7
	Grey ..	0.02	1.6	3.9	83.1	4.8	93.4
(B)	*Soils*						
BDS							
81	Red ..	2.4	4.0	15.9	71.0	0.8	92.1
79	Black ..	29.7	4.2	3.9	40.0	17.1	94.9
(C)	*Soil Below Coral (Senn)*						
BDS							
87	.. ..	1.1	4.1	17.1	67.4	1.6	91.3

TABLE II.

BULK CHEMICAL ANALYSIS

Clay Fraction (< 2 u)

Percent oven-dry clay

Lab. No.	H_2O	SiO_2		Al_2O_3	Fe_2O_3		TiO_2	CaO	MgO	K_2O	Total	SiO_2/Al_2O_3 Ratio	Base Exch. Cap. (m.e. %)
		Qtz.	Combd.		Free	Combd.							
(A) *Seawell Samples*													
O468 / A275 Red ..	11.11	1.38	46.35	25.76	3.92	6.93	0.96	0.25	1.50	1.92	100.08	3.06	43.0
O471 / A278 Grey ..	12.25	0.96	49.27	22.38	1.40	10.23	0.80	0.25	1.59	0.84	99.87	3.74	58.4
(B) *Soil Clays*													
BDS													
81 Red ..	14.18	0.97	40.76	30.56	6.53	4.15	0.99	0.22	0.72	0.01	99.09	2.27	24.5
79 Black ..	10.35	1.11	47.83	25.50	1.53	8.92	1.04	0.34	1.29	0.07	97.98	3.19	44.2
(C) *Clay Below Coral (Senn)*													
BDS / 87 Yellow ..	10.83	0.13	44.36	27.44	5.52	6.42	0.85	0.61	2.13	0.58	98.87	2.75	44.6

3. Methods of Analysis.

Further alternative methods of soil analysis have been introduced for comparison with the routine techniques at present in use. The objectives have been (a) greater accuracy in analysis with (b) increased speed.

(a) *Soil organic carbon.* The standard laboratory procedure in the past has been the modified form of the Watts' wet combination method after Hardy (Jour. Agric. Sci. 1929. 19. 727). This technique, whilst satisfactory for soils containing no free calcium carbonate, requires that for calcareous soils the free calcium carbonate must be destroyed by acid prior to making the determination. The use of concentrated sulphuric acid is not suitable for this purpose because of (i) possible organic matter charring, and (ii) incomplete destruction of the free calcium carbonate in soils of high content unless the reaction is allowed to continue for a long period during routine determinations. The use of acetic or sulphurous acid makes the procedure rather tedious.

Alternatively, the Walkley-Black sulphuric acid—dichromate wet oxidation technique is suitable for comparative routine purposes, and yields results which are uninfluenced by any free calcium carbonate in the sample. Subsequently it was found that agreement between duplicates was also much better using this technique than with the modified Watts' technique.

A comparison of these two methods was made on six selected coralline top-soil samples, and the results are recorded in Table II. Following this, the same samples were used for organic carbon determination by a method of Tinsley (Tinsley J. Trans. Int. Cong. Soil Sci. Vol. I. 1950). Tinsley found that, using a modified digestion mixture containing sodium dichromate: conc. sulphuric acid: 60 per cent. perchloric acid and refluxing gently for three hours, he obtained a mean recovery of 99.06 ± 1.33 per cent. of the soil organic carbon. (The soils used by Tinsley in his work did not contain such a large clay percentage as the coralline soils here). This is excellent when compared with a recovery of between 75—80 per cent. by the normal Walkley-Black technique. The soil samples taken were air dried, sub-sampled, and ground to pass a 60 mesh sieve.

TABLE II

Comparison of soil organic carbon determinations.

Soil	pH	Free C_aCO_3 %	Moisture %	Organic carbon (Duplicate determinations)					
				A.		B.		C.	
1. Pine	8.38	6.64	12.21	1.76	1.82	1.45	1.49	—	—
2. Belle ..	—	—	11.76	1.23	1.24	1.20	1.27	1.14	1.32
3. Codrington ..	8.78	10.30	8.46	2.19	2.12	1.53	1.51	1.61	1.44
4. Bowmanston	8.39	1.09	10.10	1.49	1.59	1.56	1.55	—	—
5. Guinea ..	7.94	0.13	11.01	1.45	1.43	1.49	1.50	1.24	1.49
6. Blowers ..	—	0.00	8.67	1.91	1.82	1.74	1.78	1.64	1.56

1—3 = Black coralline soils
4—6 = Red coralline soils
A. = Watts' wet combustion
B. = Walkley-Black wet oxidation
C. = Tinsley wet oxidation

Comparing the results by methods A. and B. it was shown that (a) there is no significant difference between the mean results obtained for the same sample by the two methods and (b) mean differences between duplicate sets of analyses by method (B.) are lower than in method A. (Watts' wet combustion Md. $=0.06 \pm 0.14$ ($= .034$), Walkley-Black wet oxidation Md. $= 0.03 \pm 0.09$ ($= .023$)).

Method C. proved impracticable for routine determinations because of severe spurting during refluxing, resulting in very erratic results. The Walkley-Black technique has been adopted for routine advisory purposes since in addition to reproducibility of results, it is a quicker, simpler technique to manipulate.

(b) *Mechanical analysis.* For the separation of soil fractions by mechanical analysis at the Government Laboratory, the I.S.S.S. pipette method (Imp. Bur. Soil Sci. Tech. Comm. 26 1933 Appendix A) is routine. This technique suffers one disadvantage when applied to the coralline soils, in that destruction of free calcium carbonate present in the sample is a step in the procedure. Free calcium carbonate in coralline soils, particularly the black rendzina type, tends to lighten these clay soils in the field, and a wrong interpretation of field texture can readily be made from mechanical analysis data obtained by this method. A technique which would allow of maximum soil particle dispersion without the necessity of calcium destruction in the several mechanical fractions is desirable.

Such a technique is described by Kilmer and Alexander (Soil Sci. 1949. 68. 15) in which use of sodium hexametaphosphate as the dispersing agent, after the peroxide treatment, instead of hydrochloric acid and sodium hydroxide as in the I.S.S.S. method, is made. Further, in this newer method, organic matter is determined directly on a separate soil sample instead of by difference as it is in the I.S.S.S. method, and oven dry soil (105°C) is the basis of calculations as opposed to the air dry sample.

It is unnecessary to describe the I.S.S.S. pipette analysis technique here, but a brief note on the modifications introduced, is given. After the peroxide treatment of a 10 gm. air dry sample (passing a 2 mm. round hole sieve) the suspension is filtered and the soil residue is dried, first on a steam and then at 105°C in an electric oven. The weight of this oven dry sample is then transferred to a 500 ml. shaking bottle together with 10 ml. of the hexametaphosphate dispersing reagent and shaken for 12 hours (over-night). The procedure from here is exactly the same as in the I.S.S.S. pipette analysis method, allowance being made in the silt + clay, and clay fractions for the weight of the dispersing reagent.

A typical set of results are given in Table III. (Sample: black rendzina type soil with low organic carbon content).

TABLE III.

	A.	B.	C.
Coarse sand %	1.13	1.11	2.67
Fine sand %	4.50	3.81	5.50
Silt %	5.29	4.51	7.20
Clay %	82.83	84.61	84.02
Free $CaCO_3$%	5.31	5.31	—
	99.06	99.35	99.39

A. = I.S.S.S. method

B. = I.S.S.S. method using hexametaphosphate reagent in place of N. NaOH

C. = hexametaphosphate method.

Treatment B. was included as a check on the dispersing power of the hexametaphosphate reagent. It will be noted that the percentage of the coarse, fine sand and silt fractions are larger due to their calcium carbonate content..

This could be seen quite clearly in the separated fractions. Often these rendzina type soils contain as much as 10 — 20 per cent or more of free calcium carbonate which makes for very appreciable increases in these fractions.

Advisory.

Twenty-one visits were made to plantations during the year in connection with soil fertility, cultivation and crop growth problems. Twenty-three soil samples were taken for advisory analysis.

Irrigation.

A programme of irrigation water application control and soil moisture investigation was commenced towards the end of 1951. The necessary electrical bridge and nylon block units were obtained for the study of soil moisture in the field by this relatively new technique. Basically, the resistance of two electrodes placed in the soil can be related logarithmically to the soil moisture content. Nylon resistance blocks are buried in the field at suitable intervals, and soil samples are taken at the site for laboratory calibration and the preparation of nylon block resistance/soil moisture graphs.

Some of the problems involved in irrigation control are :—

(a) Quick, accurate soil moisture determination in the field (as opposed to soil sampling in the field and drying in an oven in the laboratory.)

(b) Investigation of the plant available soil moisture range for the soil upon which irrigation is possible, i.e. primarily the black rendzina type coralline soils here. The plant available soil moisture range is defined as the moisture content between permanent wilting point and field capacity.

(c) The water capacity of the soils over this range, and the degree of availability to sugar cane of this soil moisture.

These investigations are being carried out in collaboration with the Irrigation and Cultivation Officers at the Government owned Pine Plantation and in the new green house recently constructed at the Department. The Pine Plantation possesses the necessary equipment for carrying out overhead irrigation.

In all, 38 nylon blocks have been sited in fields at the Pine Plantation for three main purposes :—

(a) Twelve block sites in connection with quantitative irrigation water application on Group II and IV soils cropped to cane.

(b) Eighteen blocks placed at three sites (six blocks at each site placed 3″, 6″, 9″, 12″ and 18″ deep) to study moisture variation with depth, and

(c) Eight block sites equally divided between fallow and cane crop plots, to study the moisture variations of cropped versus uncropped soil (Group II).

A total of 64 soil samples have been taken and forwarded to the laboratory for calibration and other determinations; of these, 38 are from block sites described above, and 26 are from moisture/cultivation block sites. (For explanation, see report by Cultivation Officer).

For purposes of irrigation water application control it is necessary to know the most suitable depth for placement of nylon blocks in the top-soil. Reference to sugar cane root studies carried out in this Department by A. E. S. McIntosh and G. C. Stevenson—B.W.I. Central Sugar Cane Breeding Station 1935—Bulletin No. 5 and 1936—Bulletin No. 11 revealed that these workers found

the maximum cane feeding root concentration to be at a depth of 6″ on Group II soils. Studies of normal irrigation water application in the field showed that this depth was probably optimum for water penetration under dry season conditions, supported a good forward cane growth, and was a suitable depth for moisture indication subject to further confirmation. This choice has not been disproved yet by the limited data available from the nylon blocks buried at 3″ depth intervals for moisture comparison purposes.

Soil samples are taken in the field when nylon blocks are sited and carried into the laboratory. Here they are air dried and used for the determination of block resistance/soil moisture calibration and for permanent wilting point determinations. No soil moisture tension apparatus is available at present for the correlated determination of routine laboratory measurements at 15 atmosphere tension soil moisture content (approximately permanent wilting point) or ⅓ atmosphere tension soil moisture content (approximately field capacity). Permanent wilting point determinations are made by an indirect method described by Lehans and Staple (Soil Sci. 1951. 72. 429) in which samples of air dry soil are placed in an evacuated vacuum desiccator for 14 days over sulphuric acid (1.25 per cent. by weight). Comparison of results obtained by this method with direct determination have shown agreement within 2 per cent. moisture content of samples on an oven dry basis.

In order to define, however, the available soil moisture range, the upper soil moisture limit, field capacity moisture content value, is required. The method of sampling field soils after allowing a suitable time interval for the drainage of excess water following heavy rains will be used. Meanwhile, an indirect method described by Bouyoucos (Soil Sci. 1935. 40. 165) has been tried and some results are available.

It will be appreciated that this work is in its infancy. Green-house pot trials to determine whether the small soil temperature variations occurring here effect the nylon block resistance readings significantly, and for obtaining basic indications of soil water holding capacity are envisaged shortly, in addition to extended field and laboratory work. Meanwhile, inclusion of a typical resistance/soil moisture curve for a black coralline sugar cane soil (Fig. 2), and a description of the moisture values is not without interest even at this very early stage. Together with this curve, a diagram adapted from "Irrigated Soils" by Thorne and Peterson, shows the relation between the plant available and the plant non-available soil moisture, whilst Fig. 3 is a record of actual nylon block readings obtained in an irrigated field during 1952 and shows the block resistance response to water application on a black coralline soil supporting a crop of plant canes. (Fig. 2, 3).

Referring to Figure 2, the dotted lines A. and B. show the present tentative relationship between nylon block resistance, permanent wilting point moisture and field capacity moisture values (Bouyoucos suction method). The soil moisture content between these values is generally considered to be available to plant growth. In actual fact, green-house experiments conducted by the Cultivation Officer revealed incidentally that the growth increments of corn in this type of soil had almost ceased at block readings of around 20,000 ohms resistance (line c), thus reducing considerably the range of available water for active corn plant growth. This is by no means a definitely established fact even for this crop, and may not apply at all to sugar cane.

Sugar Cane.

A. Manurial Trials reaped in the 1952 Crop Season.

All the trials reaped by the Department in the 1952 crop season were laid down as plant canes in November 1950. Reorganization of field equipment and reaping gangs has made it much easier to estimate the most suitable number of trials for reaping in a normal crop season, when considered with trials put down by the Cultivation Officer.

From a rainfall viewpoint, growing conditions during 1951 should have been above average. Nevertheless, some of the yield results were disappointing, and this is attributed to tilth conditions on these coralline clay soils following three exceptionally wet seasons which considerably restricted the time available for dry soil cultivation.

The main problem under investigation has been to potash manuring of sugar cane on the coralline soils. Leaf analyses and soil analyses have been part of the investigation, and these results are reported together with the yield results.

1. 3 x 2 factorial trials to determine the direct and residual effects of potash fertilizers. (Plant cane).

This type of factorial trial layout (3 blocks of 9 plots) tests three levels of potash fertilizer over three cane crop cycles, i.e. plant cane, 1st and 2nd ratoons, in all combinations. The cane on some plots will receive the recommended rate of potash fertilizer applied to all three crop cycles, and at the other extreme cane on some plots will receive no potash fertilizers at all. In view of the fact that previous observations point to there being no economic response to potash fertilizer on many of the coralline soils now, due no doubt to the application of regular dressings and the building up of a soil potash reserve over a period of the past 18—20 years, this type of potash trial will test response over three crop cycles adequately. The real problem is one of closer control of the potash nutrition of cane, and until adequate information can be obtained from trials like these, it is not advisable where there is a lack of response now, to omit potash fertilizer entirely for future crops. As soon as available soil reserves are taken up, and in the light of increased cane yields that will undoubtedly be reaped as time goes on, a soil potash shortage would soon occur again. Alternatively, application in excess of cane requirements does not result in an economic storage of available potash in the soil, but merely to a loss of potash in the molasses through luxury consumption of this nutrient by the cane plant.

Besides using cane yield as an indication of potash nutrition, cane leaves and soil samples were also taken from the plots and blocks of each trial, respectively. The trials themselves were sited on soils considered to be as representative of the major coralline groups as was possible within the limitations of the number of trials that could be laid down and reaped. The same variety of cane B.37161 was planted at each centre.

In Table IV are recorded the mean yield results for the plant canes; the trials were laid down on a red coralline soil in the high rainfall area (Bowmanston plantation) on a black coralline soil in the low-intermediate rainfall area (Balls plantation) and on a black sandy coralline soil in the low-intermediate rainfall area (Sandy Lane plantation). Potash fertilizer was applied in January, 1951.

TABLE IV

Treatment cwt/acre 60% M.P.	Mean yield of 9 replicates								
	Tons cane per acre			Tons sugar per acre			Per cent sucrose in juice		
	Bo.	Ba.	S.L.	Bo.	Ba.	S.L.	Bo.	Ba.	S.L.
0(A0) ..	42.09	56.66	28.10	6.36	7.99	4.18	18.44	17.14	18.73
¾(A1) ..	42.92	58.20	28.15	6.53	8.02	4.19	18.47	17.10	18.63
1½ (A2), ..	44.23	58.29	27.23	6.65	8.04	4.02	18.20	16.70	18.47

NOTE. (i) Bo. = Bowmanston plantation;
Ba. = Balls plantation;
S.L. = Sandy Lane plantation
(ii) All plots received the standard plantation application of sulphate of ammonia, i.e. 4 cwt. per acre at Bowmanston plantation; 3 cwt. per acre at Balls and Sandy Lane plantations.

There is no statistically significant difference between any of the above mean yield results due to the potash treatments. The unusually high yields recorded at Balls plantation were a result of the inadvertent application of extra sulphate of ammonia (= 3½ cwt. per acre) by the estate subsequent to the dressing applied by this Department, together with a growing season of exceptional rainfall for this area. The total yield results at the Sandy Lane plantation centre are disappointing and could hardly be attributed to a rainfall deficiency. Further reference to this is made under leaf analysis results.

Top-soil auger samples were taken at random from the three blocks of each trial; also two sets of cane leaf samples (3rd leaf counting the unopened spindle as one or the 2nd fully open leaf).

The reason why cane leaf samples were collected twice, i.e. before and after normal nitrogen application was as a check on the value of the early sampling for closer fertilizer application control. In 1951 the first leaf samples were taken at the end of May when the cane was in active growth, nitrogen was applied as sulphate of ammonia a few days afterwards, and the final leaf samples were collected at the end of July and early August.

Table V summarises the potash results obtained on both the soil and leaf samples at the three trial centres.

TABLE V

Factor	Potash treatment of plots (cwt. per acre)								
	0			¾			1½		
	Bo.	Ba.	S.L.	Bo.	Ba.	S.L.	Bo.	Ba.	S.L.
1st Leaf samples K_2O% D.M.	1.94	2.14	2.00	1.88	2.18	2.00	2.00	2.16	2.06
2nd Leaf samples K_2O% D.M.	1.34	1.36	1.34	1.46	1.44	1.36	1.56	1.52	1.54
1st Leaf samples N% D.M. †	1.35	1.04	1.04	1.26	1.06	1.05	1.31	1.14	1.03†
2nd Leaf samples N% D.M.	1.43	1.50	1.47	1.36	1.54	1.34	1.55	1.66	1.74

Exchangeable soil potash Mgms. K_2O/100 gms. soil — Bo. 16.0, Ba. 38.7, S.L. = 20.6

Note. Age of cane at 1st sampling = 6 months
" " " " 2nd " = 8 "

†Canes very yellow at all centres, and obviously nitrogen deficient.

Lengthy discussion of these results would serve no useful purpose at this early stage, but it is interesting to compare them with the diagnostic values adopted by P. Halais in Mauritius (Le Revue Agricole Vol. 27. p. 103) where this leaf analysis technique is working in the closer control of sugar cane manuring generally.

	Leaf content expressed as % D.M.		
	N.	P_2O5	K_2O
Poverty adjustment (very deficient)	1.45		0.75
Poverty adjustment (somewhat deficient)	1.45 — 1.68	0.35 — 0.45	.75 — 1.25
Normal (optimum)	1.66 — 1.85	0.45 — 0.55	1.25 — 1.75
Luxury consumption (excess) ..	1.85	0.55	1.75

N.B. Variety M 134/32; age 5—6 months.

No significant yield response to potash fertilizer application was recorded in these trials, presumably therefore the leaf analysis values recorded in Table V for the second sampling are at least within the range of optimum leaf potash content. This would be in agreement with the Mauritius values. It will be further noted that despite the lack of any significant yield response to the potash applied, the leaf potash content was apparently increased at two of the trial centres by the potash applications. Determination of leaf nitrogen content was also made on the same samples. Results for the first sampling, before nitrogen was applied, were very low, coming within the deficiency range by Mauritius standards, but the values recorded for the second set of samples were higher, though very variable, and a minority only come within the optimum range by Mauritius standards.

All the soil exchangeable potash results were equal to or in excess of the single value used in advisory work (14—16 mgms. K20/100 gms. soil) upon which potash application recommendations are made; it was possible to predict from these soil analysis results, that in all probability no response to potash fertilizer would be recorded when the trials were reaped.

2. 4 x 3 x 2 K.N.P. factorial trials. (Plant Cane)

These trials which were sited at centres situated within the different coralline soil groups, were put down to investigate simultaneously the several queries listed below:—

(i) the value of N.P.K. leaf analysis under local sugar cane growth conditions with the ultimate object of a closer control of fertilizer policy, and with the emphasis on potash;

(ii) if the technique was applicable, to establish leaf nutrient values corresponding to categories similar to Mauritius;

(iiii) to effect a further understanding of the no-phosphate response question;

(iv) to examine fertilizer interaction effects quantitatively.

The same variety of cane B.37161, was planted at all the centres, 6″ top soil samples were taken, and four sets of leaf samples when the canes were 6 and 8 months old respectively. The plots were split to allow alternative times of nitrogen fertilizer application, i.e. the layout adopted is one of two blocks of 12 plots, hence there were 48 half plots finally. All the potash and phosphate plus the early nitrogen applications were made in January 1951, normal nitrogen applications were made with the rains in early June.

The treatments were as follows:—

Muriate of Potash: 4 rates of application, 0, ½, 1 and 1½ cwt. per acre.

Sulphate of Ammonia: 3 rates of application, 0, 1½ (2), 3 (4) cwt. per acre (figures in brackets represent rate of application in high rainfall areas)

Superphosphate of Lime: (18%): 2 rates of application, 0 and 3 cwt. per acre.

Originally four trials were sited, one each at a red, a black, a black sand and a red sand coralline soil centre. The trial at the red sand centre was abandoned when the estate cut off some of the plots.

The recorded results for each trial will be considered separately because of the several factors involved.

A. *Black Coralline soil centre, low rainfall area.*

(*Friendship Plantation, St. Lucy*).

Mean Yields in tons per acre.

	No. M/P	½ cwt. M/P	1 cwt. M/P	1½ cwt. M/R	S.E.	Sig. difference
T.C.A. ..	22.90	24.47	23.35	22.98	± .75	Not. sig.
T.S.A. ..	3.17	3.41	3.26	3.20	± .11	Not. sig.
	No. S/A	1½ cwt. S/A	3 cwt. S/A			
T.C.A. ..	11.42	22.28	31.17		± .66	± 2.20*
T.S.A. ..	2.36	3.09	4.33		± .09	± 0.31*
	No. Supers	3 cwt. Supers				
T.C.A. ..	23.67	23.24			± .53	Not. sig.
T.S.A. ..	3.30	3.23			± .08	Not. sig.

*There was no significant effect on the per cent. sucrose in juice.

Time of Nitrogen application effect.

	Early	Normal	S. E.	Sig. difference
T.C.A.	21.58	31.82	± .81	± 2.42*
T.S.A.	2.98	4.44	± .10	± .29*
% Sucrose in juice ..	17.68	17.26	± .013	± .34*

Phosphate in the presence of nitrogen, significantly depressed the yield of cane and sugar per acre.

B. *Black sandy Coralline soil centre: low-intermediate rainfall area.* (Sandy Lane Plantation).

Mean Yields in Tons per Acre.

	No. M/P	½ cwt. M/P	1 cwt. M/P	1½ cwt. M/P	S. E.	Sig. difference
T.C.A. ..	25.63	25.13	26.82	25.51	± .79	Not. sig
T.S.A. ..	3.83	3.83	3.98	3.86	± .14	Not. sig
	No. S/A	1½ cwt. S/A	3 cwt. S/A			
T.C.A. ..	21.20	25.50	30.62		± .68	± 2.27*
T.S.A. ..	3.22	3.83	4.59		± .12	± 0.40*
	No. Supers	3 cwt. Supers				
T.C.A. ..	25.31	26.23			± .55	Not. sig
T.S.A. ..	3.80	3.95			± .10	Not. sig

*There was no significant effect on per cent. sucrose in juice.

Time of Nitrogen application effect

	Early	Normal	S. E.	Sig. differenec
T.C.A.	27.46	28.66	± .49	Not significant
T.S.A.	4.09	4.32	± .08	± 0.22*
% Sucrose in juice ..	18.86	18.54	± .07	± 0.19*

There were two significant interaction effects on per cent. sucrose in juice between (a) time of nitrogen application and phosphate; (b) time of nitrogen application and potash. In neither case did these fertilizer interactions affect the sucrose in juice content of cane from plots receiving the early nitrogen dressing. However, the sucrose in juice content of cane from the plots receiving nitrogen at the normal time was significantly lowered by the phosphate fertilizer, and raised by the potash fertilizer respectively. The interactions did not influence the yield of cane or sugar per acre.

C. *Red coralline soil centre, high rainfall area.*

(Guinea Plantation).

Mean Yield in Tons per Acre.

	No. M/P	½ cwt. M/P	1 cwt. M/P	1½ cwt. M/P	S.E.	Sig. diff.
T.C.A. ..	43.47	43.69	43.59	44.16	± 1.39	Not sig.
T.S.A. ..	6.23	6.42	6.39	6.35	± .14	Not sig.
	0 2½ cwt. S/A	2 2½ cwt S/A	4 2½ cwt. S/A			
T.C.A. ..	40.95	45.03	45.20		± 1.20	Not sig.
T.S.A. ..	5.89	6.55*	6.58*		± 0.12	± 0.40*
	No. Supers	3 cwt. Supers				
T.C.A. ..	45.52	44.92			± .98	Not sig.
T.S.A. ..	6.21	6.47			± .10	Not sig.

*There was no significant effect on the per cent. sucrose in juice.

It was not possible to evaluate the effects of the different times of nitrogen fertilizer application in this experiment, as the plantation applied a general dressing at the rate of 2½ cwt. per acre to all the plots after the rains came in. Reference to the preceding results does show that there was no economic response to sulphate of ammonia applied in excess of 4 cwt. per acre, the normally recommended dressing to plant canes in the high rainfall areas.

Summarising these results —

(i) There was no significant response at any of the trial centres to applications of potash or phosphate in terms of tons cane or sugar per acre.

(ii) Nitrogen at the normally recommended rate of application for each trial area gave highly significant increases of both cane and sugar per acre.

(iii) At the black coralline soil centre, normal time of application of nitrogen gave greater yields of cane and sugar per acre than the equivalent dressing applied early, i.e. in January with the potash

(iv) At the black sandy coralline soil centre this difference was significant for sugar yield only.

(v) Sucrose per cent. in juice (black and black sandy coralline soil centres) was depressed when the nitrogen fertilizer was applied at the normal time, in comparison with similar early applications. This depressing effect was not large enough to counteract the increase in growth of cane dressed with nitrogen at the normal time, or the sugar yield when compared with the early dressing, and therefore has no practical significance.

The mean values (Table VI) obtained from the leaf analysis are sufficiently encouraging to warrant continuation of this work, with the amendment that under normal conditions of nitrogen application, only one set of samples will be taken for future trials after the nitrogen fertilizer has been applied.

TABLE VI

Mean values for leaf analysis results, 1952.

4 x 3 x 2 K.N.P. trials — Plant Canes (planted Nov. 1950)

Name of Estate and manurial treatment	N %				P_2O_5 %				K_2O %			
*Guinea**	E_1	E_2	N_1	N_2	E_1	E_2	N_1	N_2	E_1	E_2	N_1	N_2
N_0 : P_0 : K_0 ..	1.266	1.435	1.272	1.539	.827	.618	.791	.572	1.82	1.95	1.90	1.90
N_2 : P_3 : $K_{\frac{1}{2}}$	1.372	1.539	1.317	1.634	.740	.585	.837	.632	1.87	2.00	1.95	1.95
N_4 : K_1	1.636	1.504	1.309	1.593					1.83	1.97	1.91	1.90
$K_{1\frac{1}{2}}$									1.80	1.95	1.94	1.97
Friendship												
N_0 : P_0 : K_0 ..	1.090	0.901	1.090	0.901	.8698	.398	.7764	.3990	1.80	1.93	1.92	1.99
$N_{1\frac{1}{2}}$: P_3: $K_{\frac{1}{2}}$	1.080	0.882	1.083	0.948	.9847	.393	.9209	.3723	1.86	1.94	1.94	2.00
N_3 : K_1	1.134	0.911	1.150	1.086					1.86	1.92	1.93	1.96
$K_{1\frac{1}{2}}$									1.88	2.02	1.92	1.90
Sandy Lane												
N_0 : P_0 : K_0 ..	1.064	1.072	1.064	1.072	.5473	.4992	.4979	.6540	1.93	1.86	1.94	1.81
$N_{1\frac{1}{2}}$: P_3: $K_{\frac{1}{2}}$	1.134	1.084	1.075	1.029	.4840	.5533	.4543	.5960	2.01	1.80	2.03	1.82
N_3 : K_1	1.282	1.071	1.117	1.013					2.09	1.85	2.04	1.83
$K_{1\frac{1}{2}}$									2.08	1.94	2.01	2.03

E = early S/A application, Jan; N = normal S/A application, June. 1 = 1st sampling
(* Guinea: extra 2½ cwt. S/A applied by estate, but after 2nd sampling) 2 = 2nd sampling.

These results may be compared with the Mauritius standards bearing in mind that there was apparently no response at any centre to potash or phosphate. The mean leaf phosphate control values for the no-phosphate plots are generally high, and show no positive indication that the applied phosphate had been taken up in the leaves at the time of sampling. Mean leaf potash values, unlike the previous results (Table V) remained high at the time of the second sampling. Mean leaf nitrogen values for the second set of leaf samples appear to be very low at the black soil (Friendship plantation, St. Lucy) and the black sandy soil (Sandy Lane plantation) centres, in comparison with the values recorded at the third (red soil) centre. At the first named trial centre, the very low mean leaf nitrogen values recorded may have been a result of the rather severe water logging of a part of the trial area during most of the wet season.

Soil Analysis results (Mean of duplicate sets of samples)

	Total nitrogen %	Exchangeable potash: mgms. K_2O/100 gm. soil
Friendship (St. Lucy)	.091	23.6
Sandy Lane	.089	23.0
Guinea	.152	12.6

Soil nitrogen values are low at the black and black sandy soil centres; soil exchangeable potash is low at the red coralline soil centre, and a response to potash fertilizer would have been predicted on the basis of this figure.

3. *Sugar Cane Arrowing.*

The Botanist, B.W.I. Central Sugar Cane Breeding Station described how during the growing season of 1951, it has appeared that the application of extra potash fertilizer to cane varieties at the nursery centre (red coralline soil group) increases the incidence of arrowing. Since the treatments in the 3 x 3 x 3 factorial K_2O trials already described were comparisons of different rates of potash application, plot counts of arrows were made at the time of reaping the cane. The potash dressings, however, were not extra applications in the same sense as refrred to above, i.e. dressings in excess of normal routine application.

Mean results are recorded in Table VII.

TABLE VII

Treatment	Mean Yield of 9 replicates		
cwt/acre ..	Arrows per plot ($^1/_{58}$th acre)		
60% M/P ..	Bo.	Ba.	S.L.
0 ..	17.6	17.5	95.0
¾ ..	17.3	17.0	96.1
1½ ..	20.0	16.0	101.1

Note: Bo. = Red coralline soil, high rainfall area;

Ba. = Black coralline soil, low-intermediate rainfall area;

S.L. = Black sand coralline soil, low-intermediate rainfall area.

Cane variety B.37161, no significant difference in arrows/plot due to potash treatments. At two centres (Bo. and S.L.) there were significant block differences.

The potash dressings applied in these trials did not significantly effect the cane arrowing. What is of interest, however, is the obvious difference between the amount of cane arrowing which occurred on the heavy soils (Bo. and Ba.) and the lighter soil (S.L.). Further, the effect of soil variation was brought out in the differences between the three blocks of plots at Bo. and S.L. trial centres.

Plot counts of arrows were also taken when the 4 x 3 x 2 K.N.P. factorial trials were reaped. The number of arrows per plot were not related to the potash dressings, in fact, there were no significant differences due to any of the manurial treatment. There was, however, a very significant difference between blocks at the black soil centre (Friendship plantation, St. Lucy) due to soil variations. Block I gave a mean value of 27.1 and block II a mean value of 39.6 arrows per cane plot. Observations made during the growing season in which there was well above the average rainfall, were that excess water took longer to move off the soil surface in many of the plots in block II, and internal drainage was much retarded. The soil was probably deficient in air essential for root growth and soil compaction did occur to a greater degree on these plots with the resultant poorer surface root expansion and much earlier maturation. The cessation of rain in December 1951 followed by a droughty two months before reaping, hastened this process in relation to the freer draining plots in block I.

4. *Organo-Mercurial dip (Aretan) trial.*

This trial was laid down in November 1950 on a black coralline soil, low rainfall area, to investigate the value of this chemical in relation to germination under dry rainfall area conditions in Barbados, and final cane yield. It is unfortunate in respect of this trial, that an exceptional rainfall year followed planting. Precipitation was not only high during the normal wet season, but in the dry season months (January—April) as well. Three commercial cane varieties B.37161, B.4098 and B.41211 were grown, the control cane setts were dipped in water. Dip solution strengths were ½ to 1 per cent solutions.

The trial was planted on November 22nd, 1950; germination counts made December 27th, 1950; tiller counts made March 1st, 1951. The recording of all the data obtained will not be undertaken here, and since yield is the ultimate criterion of the values of this treatment, these results only are recorded in Table VIII.

TABLE VIII

Variety treatment	% Aretan in Solution	Mean of 3 replicates			
		Tons cane per acre		Tons sugar per acre	
B.37161 ..	0	40.07		5.92	
	½	45.84	M.V. = 42.7	6.74	M.V. = 6.25
	1	42.55		6.11	
B.4098 ..	0	44.53		7.02	
	½	45.44	M.V. = 44.0	7.10	M.V. = 6.88†
	1	42.13		6.55	
B.41211 ..	0	50.47		7.19	
	½	55.49	M.V. = 52.3†	7.91	M.V. = 7.52†
	1	50.83		7.47	

Note: M.V. = Mean value for a particular variety.

(i) Neither the Aretan treatments generally, nor the interaction between cane variety × Aretan treatment, significantly affected yields of cane or sugar/acre.

(ii) † = Increase in mean yield significant at P — 0.01.

Referring briefly to the germination count made in December 1950, B.4098 was significantly slower in germinating than either of the other two varieties. The data obtained from the tiller counts made in March 1951, showed significant differences between varieties, i.e. B.4098 and B.41211 had a greater number of tillers per cane hole than B.37161, and the setts dipped in ½ per cent. aretan solution had tillered the best. This latter trend persisted in the yield results for each variety, but the differences were not statistically significant.

No definite experimental evidence can be produced for Barbados conditions to support the statement that dipping cane setts in aretan increases the yield of cane and sugar per acre. It still remains, however, to test this technique during a normal dry season, when its value in decreasing the mortality of slow germinating cane setts might become apparent.

B. New Trials to be reaped in the 1953 Crop Season.

(i) Two further trials of the 3 x 3 x 3 direct and residual potash investigation type were laid down, one at a red sand coralline centre, and one at a black soil centre.

(ii) Two trials were laid down to investigate the value of bagasse in sugar cane production. Although they were drawn up with a similar object in view, they were modified to bring them into line with the normal treatment of bagasse at the two plantation centres. One trial is situated on a red coralline and one on a Bulkeley valley soil.

(iii) Before trials centres are chosen, the soil group of the selected site is determined. Of the four trials just mentioned, all are on group II soils with the exception of the black coralline soil bagasse trial. This is sited on a heavy group IV.

Milling Laboratory

During the 1952 crop season 968 samples of cane were received for analysis in connection with Departmental manurial trials and with the select seedling and variety trials of the B.W.I. Central Sugar Cane Breeding Station. Of this total number 533 were received for the analysis of sucrose in cane, the remaining 435 samples were subjected to full analysis, i.e. cane juice sugar, megasse fibre, megasse sucrose and moisture by difference.

Animal Nutrition:

1. Milk Analysis

Monthly milk samples were received for routine analysis from the Central Livestock Station. Evening and morning samples are taken for each cow, and on receipt in the laboratory are bulked into a single cow sample in yield proportion. A summary of the analyses is recorded in Table IX.

TABLE IX

Month	No. of cow samples	Mean per cent. butter fat	Mean per cent. solids not fat (by calculation)
April 1951	28	4.1	8.7
May „	32	4.2	8.6
June „	32	4.5	8.6
July „	34	4.6	8.5
August „	33	4.5	8.5
Sept. „	34	4.5	8.5
October „	33	4.4	8.6
Nov. „	25	4.6	8.7
Dec. „	No	samples	
January 1952	33	4.6	9.2
February „	29	4.4	9.3
March „	33	4.3	8.8

N.B. Mean values are weighted.

The dairy herd is of mixed breed (Friesian and Guernsey) and there are different grades within each breed as a result of top-crossing foundation cattle with purebred bulls.

2. Fodder Investigation

The perennial fodder trial which was being carried out at the Government owned Pine Plantation is now completed. Results cover two consecutive 12 month periods, and a full report has been completed. A summary of the data is presented here. (Table X.)

TABLE X

Mean yields per acre per annum—1st year (Mid December, 1949—Mid December, 1950).

Fodder Grass and Treatments			No. of cuttings during the period	Green Fodder (tons per acre) Mean of 3 replicates	C.P. in D.M. (per cent)	C.P. in G.M. (per cent)	C.P. per acre (lb.)	D.M. in green material (per cent)	D.M. per acre (tons)
Grass	Height cutting	N/S applied (*cwt.)							
Guatemala grass ..	2	½	6	16.15	6.77	1.50	547	22.7	3.8
„ ..	3	½	5	15.92	5.39	1.34	478	24.9	4.0
„ ..	4	½	3	13.66	3.77	0.97	297	25.7	3.5
Guatemala grass ..	2	1	6	21.80	6.51	1.48	723	22.8	5.0
„ ..	3	1	5	19.85	5.15	1.41	627	27.4	5.4
„ ..	4	1	3	15.44	3.76	0.78	270	20.7	3.2
Uganda grass ..	2	½	7	26.37	5.46	1.00	666	18.3	4.8
„ ..	3	½	6	25.32	5.36	1.01	573	18.3	4.6
„ ..	4	½	5	22.74	4.87	0.98	499	20.8	4.7
Uganda grass ..	2	1	7	29.72	5.44	1.13	752	20.7	6.2
„ ..	3	1	6	35.43	5.58	1.04	825	18.7	6.6
„ ..	4	1	5	35.82	4.40	0.95	762	21.6	7.7

Notes:

(i) Mean yields of fodder grasses for all treatments
Guatemala Grass = 17.14 ± 1.45 tons per acre per annum
Uganda Grass = 26.35 ± 1.45 tons per acre per annum
} Sig. diff. = 8.82 tons per acre per annum at p = 0.05.

(ii) Mean yields of fodder grass due to nitrogen treatment
½ cwt. N/S per acre = 20.03 ± .63 tons per acre per annum
1 cwt. N/S per acre = 26.35 ± .63 „ „ „ „ „
} Sig. diff. = 2.65 tons per acre per annum at p = 0.01.

(iii) Mean yields of nitrogen treated fodder grasses (nitrogen x fodder grass interaction)
Guatemala ½ cwt. N/S = 15.25 ± .78 tons per acre per annum
Guatemala 1 cwt. N/S = 19.03 ± .78 „ „ „ „ „
Uganda ½ cwt. N/S = 24.81 ± .78 tons per acre per annum
Uganda 1 cwt. N/S = 33.66 ± .78 „ „ „ „ „
} Sig. diff. = 2.98 tons per acre per annum at p = 0.05.

TABLE XI.

Mean Yields per acre per annum — 2nd Year (Mid December, 1951 — Mid December, 1952)

Fodder Grass and Treatments									
Grass	Height of cutting (ft.)	N/S applied (* cwt.)	No. of cuttings during the period	Green Fodder (tons per acre) Mean of 3 replicates	C.P. in D.M. (per cent)	C.P. in G.M. (per cent)	C.P. per acre (lb.)	D.M. in green material (per cent)	D.M. per acre (tons)
Guatemala grass ..	2	½	4	10.75	5.14	1.18	284	22.9	2.5
„ ..	3	½	4	10.32	4.07	0.97	224	24.0	2.5
„ ..	4	½	3	12.06	4.44	1.07	289	23.3	2.9
Guatemala grass ..	2	1	4	12.52	5.38	1.20	337	22.1	2.8
„ ..	3	1	3	11.79	3.69	.89	235	24.1	2.8
„ ..	4	1	2	14.32	4.98	1.23	395	24.5	3.5
Uganda grass ..	2	½	5	17.30	5.00	.91	353	18.6	3.2
„ ..	3	½	4	14.94	4.53	.97	325	21.4	3.2
„ ..	4	½	3	11.66	4.26	1.02	266	23.6	2.8
Uganda Grass	2	1	5	20.75	5.10	1.03	479	20.2	4.2
„ ..	3	1	4	19.04	4.87	1.23	525	19.2	3.7
„ ..	4	1	3	16.64	4.77	1.13	421	23.3	3.9

Notes:

(i) Mean yields of fodder grasses for all treatments

Guatemala grass = 11.96 ± .69 tons per acre per annum
Uganda grass = 16.72 ± .69 tons per acre per annum
} Sig. diff. = 4.22 tons per acre per annum at p = 0.05.

(ii) Mean yields of fodder grass due to nitrogen treatment

½ cwt. N/S per acre = 12.84 ± .12 tons per acre per annum
1 cwt. N/S per acre = 15.85 ± .12 „ „ „ „ „
} Sig. diff. = 0.42 tons per acre per annum at p = 0.05.

(iii) Mean yields of nitrogen treated fodder grasses (Nitrogen x fodder grass interaction)

Guatemala ½ cwt. N/S = 11.04 ± .17 tons per acre per annum
Guatemala 1 cwt. N/S = 12.88 ± .17 „ „ „ „ „
Uganda ½ cwt. N/S = 14.64 ± .17 tons per acre per annum
Uganda 1 cwt. N/S = 18.81 ± .17 „ „ „ „ „
} Sig. diff. = 1.67 tons per acre per annum at p = 0.05.

(iv) Mean yields of fodder grasses as effect-by height of cutting (height of cutting x fodder grass interaction)

Guatemala 2 ft. = 11.64 ± .98 tons per acre per annum
„ 3 ft. = 11.06 ± .98 „ „ „ „ „
„ 4 ft. = 13.20 ± .98 „ „ „ „ „
Uganda 2 ft. = 19.03 ± .98 tons per acre per annum
„ 3 ft. = 16.99 ± .98 „ „ „ „ „
„ 4 ft. = 14.15 ± .98 „ „ „ „ „
} Sig. diff. = 3.21 tons per acre per annum at p = 0.05.

This trial was not irrigated, and the method of cutting the plots at fodder heights as opposed to stated time intervals was adopted. A total of 99 plots were cut in the period under review, and 33 samples were received for analysis.

No discussion of these results will be recorded here as this will be available in the form of a separate publication shortly.

SECTION VII.

GOVERNMENT LABORATORY

BY

N. CARMICHAEL

Government Analyst

Analytical Work

The total number of samples examined over the period April 1st, 1951 to March 31st, 1952 for the various Government Departments and for private individuals amounted to 1,926.

The number and distribution of samples dealt with annually for the past five years is set out in Table I.

TABLE I.

Distribution of Samples over the period 1947—1951

	1947	1948	1949	1950	1951-52
Police Department ..	236	205	274	348	408
Customs Department	98	95	126	105	78
Public Works Department	7	14	15	—	—
Agricultural Department	179	199	491	572	988
Parochial & Sanitary Dept.	333	330	331	357	330
Agricultural Society	56	40	83	28	25
Other Departments ..	41	53	55	38	14
Private Individuals ..	153	235	220	83	83
Total	1,103	1,171	1,595	1,531	1,926

Particulars of the various samples examined and analysed in the "Food and Drugs Laboratory" throughout the year are given in Tables II to V *et. seq.*

TABLE II.

Samples analysed for the Police Department

Sample	No.
Viscera, examination of Poisons & Exhibits	63
Coins and Counterfeiting Exhibits	46
Butters and Cooking Oils	21
Milks	111
Tea, Coffee, Cocoa, etc.	16
Animal Feed	8
Rum	41
Miscellaneous	102
Total	408

(a) *Milks*:— Two (2) out of the 111 samples of milk examined were found to be adulterated by the addition of water.

(b) *Rums*:— One (1) out of the 41 samples received showed added water. Eleven (11) alcoholic beverages containing more than 2 per cent. proof spirits were classified as 'Beer' according to the Brewery Act, 1950.

TABLE III.

Samples analysed for the Customs Department.

Sample	No.
Tea, Coffee, Cocoa, etc.	—
Butters and Cooking Oils	9
Milks	11
Petroleum	37
Rum	9
Miscellaneous	12
Total	78

Remarks:

(a) Miscellaneous:—These comprised —
(i) Overhead Lubrication for internal combustion engines bearing the Trade Name "ADCOIDS".
(ii) Samples of Ajax and Octogan detergents.
(iii) Beef Loaves.
(iv) Water proof 'Wash' for walls.
(v) Glass measuring cylinders and hydrometers for calibration.

(b) Hydrometers and Cylinders:—As regards the hydrometers referred to in item (v) above, 4 were examined, and all of them were worthless. One of the two glass measuring cylinders had a zero error of 8.3 per cent.

All samples received with the exception of item (v) of those designated 'Miscellaneous' were for the purposes of classification according to Tariff Laws.

TABLE IV.

Samples examined for Parochial and Sanitary Departments.

Sample	No.
Milks	320
Food Stuffs	9
Waters	—
Miscellaneous	1
Total	330

Remarks:

(a) Milks:—of a total of 320 samples examined, 15 showed added water; and in one other case 27 per cent. of milk fat had been extracted. Water added to adulterated samples reached as high as 32 per cent.

(b) Food Stuffs:—These comprised —
(i) 2 Cold-storage ducks,
(ii) 3 Cheeses,
(iii) 4 Mushroom Soups.

The ducks and the soups showed signs of decay and were returned as unfit for human consumption.

TABLE V.

Samples examined for Private Individuals

Sample	No.
Butters, Margarines, Cooking Oils	3
Fertilizers	18
Feeding Stuffs	7
Milks	7
Hydrometers	1
Sugar and Molasses	2
Viscera (Faeces)	4
Waters	16
Unclassified	25
TOTAL	83

Department of Agriculture.

A total of 988 samples were received. These will be discussed under "CHEMISTRY" in other Sections of this Annual Report.

Agricultural Society.

Twenty-five (25) samples of Rum were examined in connection with the Annual Industrial Exhibition.

Other Government Departments.

The Barbados General Hospital:—14 samples were received; 13 of these were E.C. disinfectant and one was a sample of Anaesthetic Gas.

General Remarks.

The figure 1,926 in respect of samples received for the Financial Year 1951-52 is a record number for this Department. It has been, in part, due to a steady increase in the number of Police samples over the past five years; but mainly to a phenomenal rise in the number of Agricultural samples which since 1948 has more than quadrupled itself. (See Table I).

Most alarming is the number of Viscera exhibits which this year has reached the high figure of sixty-three! (see Table II). Indeed this number shows an increase of more than fifty per cent. on any of the previous years. It, moreover, exceeds the grand total received and examined by this Department over the past three years (January 1948 to March 1951 inclusive) by 8.5 per cent.

SECTION VIII.

ENTOMOLOGY

R. W. E. TUCKER,

Entomologist

Entomological work during the period under review was mainly concerned with the maintenance of effective control over cane moth borer *Diatraea saccharalis;* with evolving a practical and economic method of controlling cane root grubs and other cane root pests by means of soil insecticides; with an examination of the field prevalence and control exerted by parasites of scale and other insects introduced from Trinidad and with a general watch over insect pests of food and other crops.

A new cane root pest was brought to the notice of the Department this year; new, that is in the sense that it had not been noticed before. It is found to be widely, but patchily spread through the Island, and can, under some conditions, cause what at present appears to be a noticeable drop in ratoon tonnages where conditions favour its activities. This pest, a root mealy bug and its ant carrier, will be described later.

The services of wood ant inspection and control were maintained as usual. This year, the activities of the Wood Ant Inspector were extended to cover inspections for presence of field wood ants in freshly reaped cane fields to obtain a survey of cane field wood ants.

Control of *Diatraea saccharalis,* (the small borer of sugar cane).

During the year under review, a total of 343,617,000 parasites of the eggs of *D. saccharalis* was bred in the laboratory, and of these, a total of 300,664,900 was available for field distribution after retaining the necessary proportion for the maintenance of the breeding cycle.

In last year's Annual Report mention was made of the fact that the results of 20 years' work on this method of control had been written up and published, and in that account it was stated that it was not expected that the next few years would show much change in the general overall cane internode infestation of between 10 per cent. and 11 per cent. The latest results have, however, shown that in 1951 average infestation was reduced to 7.8 per cent., and in 1952 to 8.6 per cent. damaged internodes. Infestation may rise again in other years according to climatic and other conditions, but the fall in infestation during the past two years is worth recording. Additional support for control of *D. saccharalis* by mass liberations of *Trichogramma* was obtained from an outside source, where, the conditions being described by trained observers, and the *Trichogramma* liberations being under the control of trained personnel, large numbers of the mass reared parasites were despatched by aeroplane from the laboratories here in June 1951. The results, furnished in March 1952, state that stalk studies made by the Agronomist show that "we reduced borer infestation some 50 per cent. in the areas treated as compared to untreated areas", and this reduction had "obvious effect . . . on juice quality and we are very anxious to increase the *Trichogramma* population as soon as possible." Thus evidence over a period of 20 years recently published, plus subsequent figures recorded for Barbados, receives confirmation.

Work on the relation between *D. saccharalis* and cane varieties was maintained as usual, as was the work carried out annually on extent of *D. saccharalis* egg deposition over a period of 6 to 7 months each year in blocks of different varieties of cane, and on the monthly average rate of *Diatraea* egg deposition and extent of field parasitism by *Trichogramma minutum*.

Field collections and laboratory dissections of young plant cane shoots damaged by *D. saccharalis* were started again in order to ascertain whether any of the larval parasites *Lixophaga diatraea* liberated during years of good rainfall could be recovered from the field. Up to the end of March 1952, none had been recovered.

Root Borer (Diaprepes abbreviatus) and Brown Hard-back (Clemora smithi).

In the last Annual Report an account was given of results to that time of plot experiments and larger field experiments with Gammexane (Agrocide dusts). These experiments conducted on the basis of cane hole treatment showed at first only negative results due to phytotoxicity, this year, however, positive results showed in some of the trials reaped as ratoons. In the meantime, for reasons already given, cane hole treatment was replaced by broadcast treatment, and hand application was replaced entirely by mechanised application. For this to be an economic treatment, a change was made to the new chemical Aldrin, which could then be obtained in a technically pure grade, thus saving freight and enabling local material (ground coral limestone) to be used as dust diluent. This price advantage, however, disappeared, but as the Aldrin had been ordered by then, experiments with aldrin-limestone dust broadcast by tractor-drawn distributor and harrowed in with a following tractor-drawn harrow were carried out from June onwards in 1951. Tests of method of application of the insecticide had shown that broadcast application of dusts was far more practicable in Barbados than field applications of the same amount of insecticide as a water spray. Mechanical broadcast and incorporation in the soil of dusts was therefore adopted in preference to wet spraying.

The weather during this period of experimental field application proved to be exceptionally rainy, so that normal plantation cultivation was often hard to carry out. It was therefore even harder to assemble the requisite mechanised equipment on suitable fields when the rains slackened and the fields dried out sufficiently for such work.

Despite excellent co-operation on the part of the planters, it was possible to treat only 48 acres instead of 70 as planned, before planting began again. Moreover, many fields were partially flooded, or rendered completely sodden by heavy rains immediately after treatment; others suffered later from trash fires which damaged the young cane, or were not planted in cane in 1951.

Whether the heavy rains were responsible, or whether the treatment (4 lb. aldrin per acre harrowed in) was inadequate, the fact remains that so far no obvious difference can be seen between treated and untreated portions of fields, and in one treated field which did receive a heavy root borer attack, the aldrin treated area was almost completely wiped out by the root borer attack.

There has been adequate reason, therefore, to reconsider the case for gammexane, especially as gammexane, on the basis of gamma isomer per acre had not been used in mechanical broadcast methods.

Naturally pot experiments had been carried out prior to field experiments, but these were mainly to ascertain the effect of the powdered coral limestone used as filler on cane growth.

With the advent of some drier weather, further broadcast plot experiments were started in late 1951 and early 1952 to ascertain—

(a) whether sweet potatoes were "tainted" by being grown in soil receiving 4, 6 and 8 lb. of gamma isomer per acre broadcast with ground coral limestone;

(b) whether applications of 1,000 lb. or more of limestone containing gammexane affected cane growth; and

(c) whether surface dusts of gammexane on to mulched plots were equal to or preferable to the incorporation in the soil of the same application of gammexane.

So far only the sweet potato "taint" experiment has been concluded, and the results of this experiment, summarising the verdict of a number of 'tasters' was that there was no taint at all and no one could say whether the potatoes came from treated or normal untreated areas.

All experiments are mainly concerned with the control of root borer grubs in the soil, as it is felt that brown hard-back grubs will most certainly be killed by the same treatment. It is of interest to note that brown hard-back beetles began to swarm in 1952 much earlier than is usual. Some flights occurred early in March; at the same time more and earlier reports were received of the occurrence of the firefly beetle *Pyrophorus luminosus* an importation made 20 years ago from Puerto Rico. The larvae of this Elaterid beetle live on brown hard-back grubs in the soil; and, due probably to the recent years of heavy rainfall, the beetles have spread to wooded areas on the leeward coast; none of them were originally placed out in such areas.

Food Crops and Garden Crops

Inspections, advice and the loaning by the Department of spray apparatus for insect pest control was maintained as usual. The sale by the Department of a small range of insecticides for spraying purposes in vegetable plots and gardens continues to be successful.

Imported Parasites and Predators

No new importations were made during the year under review and of the list of species given in last year's report, *Prospaltella* n sp. has become established and has controlled coconut white fly (*Aleurodicus cocois*) in many areas. The parasite *Apanteles glomeratus* introduced to assist in controlling *Ascia monuste* the white cabbage butterfly still appears in irregular numbers in scattered areas.

Coccinellids introduced from Trinidad for control of scale insects are in a few cases maintaining themselves successfully and effecting some control of scale insects. The coccinellid *Chilocorus cacti* was universally found in large numbers in 1951 following its first recorded collection early in 1950. Whether this is a case of a dormant local species suddenly becoming active or if the success of one of the species in a few of the "mixed bags" of coccinellids introduced in 1949 from Trinidad through the medium of the Commonwealth Institute of Biological Control, is not known.

Cane Root Infesting Mealy-bugs

The root infesting coccid *Neorhizoccus* sp. n. nr. *Colombiensis* Hamb. and the associated ant *Acropyga* (*Rhizomyrma*) *marshalli* Craw. were found in

considerable numbers on and around the roots of ratoon in 1951 and 1952 following reports from two widely separated plantations, that ratoon canes were in some fields or portions of fields failing badly despite adequate rainfall. The first step taken was to ascertain with the Soil Cultivation Officer whether the soil in affected fields was in a good or a bad state of tilth. The soil tilth was found to be well up to standard and poor soil tilth could not therefore be considered as the main or primary cause of ratoon failure. In some fields or portions of fields where *Acropyga* had made extensive tunnels and small chambers in the soil in which mealy bugs (*Neorhizoecus*) and eggs, larvae and pupae of *Acropyga* were being reared there was some compacting of soil and reduction of tilth due to the activities of the ant, but this soil condition did not appear to be a primary cause of ratoons failing.

The next step was to ascertain that this presumably new mealy bug attacked, or was farmed out by the ants on newly formed and vigorous cane roots, thereby causing their eventual death.

The third step, as yet incomplete, was to ascertain the extent of infestation. At first, only light, red soils in hillier regions where cases of ratoon failure were first reported, were found to be infested, but later on some black soil areas were found infested. Both ants and mealy bugs were found at the roots of grasses and some weeds in cane traces and in sour grass pastures.

The ant mealy bug association which is probably broken up and reduced by digging out ratoons, preparing the cane fields by ploughing, harrowing etc. and by digging out provision crops, has so far been found rarely and only to a slight extent in plant cane fields, but builds up noticeably in some ratoon fields according to their age and proximity to infested or 'reservoir' areas.

The ant *Acropyga marshalli* belongs to a genus noted for fostering subterranean mealy bugs, especially the genus *Rhizoecus* and some of these mealy bugs are recorded as causing serious damage to plants and even to trees such as cacao, banana and coffee.

The subterranean or root infesting mealy bug *Neorhizoecus* species, probably new, but related to *N. colombiensis* is, from evidence so far accumulated, the primary cause of cane ratoon failures in whole fields or in portions of fields. It is not, as yet, prevalent all over the Island, and there is insufficient evidence so far to say how long it has been established in Barbados because in many cases, but not in all cases, other causes of failure are present, namely root borer *Diaprepes abbreviatus* and the cane field termite *Nasutitermes costalis*. It is known that the associated ant *Acropyga marshalli* a distinctive, moderately large golden yellow ant was found and recorded many years ago in Barbados.

Much more will have to be found out about the soil inhabiting cane root damaging insects of Barbados before the exact role played by *Acropyga* and *Neorhizoecus* can be assessed in relation to ratoon failures caused by root borer and occasionally by termites.

Wood Ant Control. The demand for the services of the Wood Ant Inspector for both public and private buildings continues to the same extent as in former years, but at the reaping of the cane crop, a portion of his time was devoted this year to examining newly reaped fields for the presence of live and empty wood ant nests. The numbers found so far have been considerable.

Economic Zoology

Advisory work on the control of rats in cane fields and of slugs and crabs in gardens and vegetable plots has continued as usual.

SECTION IX.

PLANT DISEASES AND COTTON

By
D. R. D. WILES,
Plant Diseases Inspector.

Mosaic Disease of Sugar Cane.

Ninety-three (93) returns were received this year in accordance with the provisions of the Mosaic Disease (Eradication) Act 1943 (1943—22) and four (4) infected holes were reported. These infected holes were destroyed immediately on being found and no further infected holes were observed in this area. The Island's crop is at present being planted in highly resistant varieties and this, no doubt, accounts for the continued absence of infected holes.

Cotton.

The Okra and Cotton Close Season was again proclaimed and extended for a period of two months (1st May—30th June). It has been hoped that the extension of the growing period by a month as well as the very good price which had been fixed would have resulted in an increased acreage being planted. This did not materialise and seed was only distributed to plant 136¼ acres, made up as follows:—plantations, 15; peasants, 121¼; of which 126 acres were reaped which gave the following yield:—

Seed Cotton	39,566 lb.
Lint	10,018 lb.
Ginning percentage	25.29 %

Through the co-operation of the Barbados Co-operative Cotton Factory Limited, a supply of Sulphate of Ammonia was made available to approved growers and it is pleasing to record that those who made use of this assistance were rewarded by good yields. The average yield of seed cotton per acre has remained low due to growers not practising proper cultural methods.

Cotton Selection.

The variety trials A and B were again carried out at Codrington. Trial A was planted in the following varieties, viz., B.4310, B.4404, B.4411, B.4413, B.4702, B.4705, B.4706, B.4807 and B.4905 using B.1 as standard. Trial B was planted using the following varieties, viz., B.1 (3), B.4805, B.4902, B.5001, B.5003, B.5004, B.5005, B.5006, B.5007 and B.1 as standard.

Selection of seed for the Progeny Row trials was made from the following varieties, viz., B.1, B.4310, B.4404, B.4413, B.4212, B.4401, B.4411 from which yields of over 1,200 lb. of seed cotton had been obtained. Seven strains were selected for further trial.

The average lint length has been maintained at 60 mms. and no bales were rejected by the Liverpool graders, top price being obtained for the Island crop.

Cotton Pests and Diseases.

The search for "Wild Cotton" trees was continued during the year and 3,925 trees were found and destroyed. These "wild cotton" trees were found in pasture lands, tenantries and gullies.

The defoliating worm, *Aletia argillacea,* made its appearance at the usual time but the attack was not as severe as in previous years and was easily controlled by spraying with lead arsenate or dusting with a mixture of Paris green and slaked lime. It is with regret that the pink bollworm of cotton made its appearance in December, 1951, after an absence of several years. The attack was slight, being only found in the parish of St. Philip. Growers co-operated well in assisting to control this pest by cleaning up their plots at an early time and not waiting until the Close Season commenced.

There was also a slight attack of Angular Leaf Spot but this in no way affected the yield.

Plant Pest and Disease (Importation) Act.

Twenty-eight (28) permits to import planting material were issued under this Act.

One hundred and ten (110) export certificates were issued during the year.

Miscellaneous Inspections of Imported Planting Material.

332	packages of bulbs, vegetable and flower garden seeds and Rose trees	—	examined & passed
2	crates Coconut plants	—	„ „
1,767	Coconut plants	—	„ „
12	Mango plants	—	„ „
1	package Loofah seed	—	„ „
1	„ Gardenia plants	—	„ „
1	„ Hydrangea plants	—	„ „
2	Hydrangea plants	—	„ „
2	Pear plants	—	„ „
1	package Cacti plants	—	„ „
5	cases Orchid plants	—	„ „
23	packages Orchid plants	—	„ „
59	Orchid plants	—	„ „
2	cases Rose trees	—	„ „
12	packages Rose trees	—	„ „
40	Rose trees	—	„ „
1	Ixora plant	—	„ „
30	bundles Xmas Trees	—	„ „
21	packages Bulbs	—	„ „
5	cases Bulbs	—	„ „
2	packages Gerbera plants	—	„ „
3	packages Citrus plants	—	„ „
1	package Hibiscus cuttings	—	„ „
1	Passion Flower plant	—	„ „
2	packages Anthurium Lily plants	—	„ „
26	Anthurium Lily plants	—	„ „
3	packages Miscellaneous plants	—	„ „
11	Miscellaneous plants	—	„ „
1	package Cassava cuttings	—	„ „
1	Rose tree	—	Roots washed

1 Nutmeg plant	..	..	..	..	—	Roots washed
1 Begonia plant	..	..	..	..	—	„ „
6 Banana Suckers	..	..	..	..	—	Destroyed
12 Coconut plants	..	..	..	..	—	„ „

In addition to the above, 98 bales of cotton lint imported by the Barbados Knitting & Spinning Co., Ltd., were inspected as well as articles suspected of containing raw cotton.

Appendix

COMPARISON OF GROWTH RATES OF WILTSHIRE HORN AND BLACK BELLY SHEEP

Weights of Half Bred Wiltshire Horn Sheep

(Wiltshire Horn x Black Belly)

Number	Weight at Birth	1st Month	2nd Month	3rd Month	4th Month	5th Month	6th Month	7th Month	8th Month	9th Month	10th Month	11th Month	12th Month
1	8	24	36	48	62	71	83	90	100	112	134	136	140
2	9	22	42	50	58	64	68	71	74	81	90	88	92
3	8½	18	32	46	54	60	76	82	95	105	112	110	120
4	10	26	43	55	65	72½	83½	97	113	118	143	150	161
5	8	19	32	37	44	51	57½	63½	71	80	88	97	107
Total ...	43½	109	185	236	283	318½	368	403½	453	496	567	581	620
Average	8¾	21¾	37	47¼	56½	63¾	73½	80¾	90½	99¼	113½	116¼	124

Weights of Pure Bred Black Belly Sheep

Number	Weight at Birth	1st Month	2nd Month	3rd Month	4th Month	5th Month	6th Month	7th Month	8th Month	9th Month	10th Month	11th Month	12th Month
1	8	21	37	50	55	70	82	90	94	100	108	112	115
2	9	18	32	39	47	55	62	66	71	76	81	86	95
3	8½	22	29	37	42	50	61	65	72	80	91	102	110
4	10	18	26	37	40	42½	50	55	62	68	71	77	78
5	8	29	35	47½	58	65	78	89	100	114	121	121	124
Total ...	43½	108	159	210½	242	282½	333	365	399	438	472	498	522
Average	8¾	21¾	31¾	42	48½	56½	66½	73	77	87½	94½	99½	104½

SECTION X.

ANIMAL HUSBANDRY

1. Cattle

Cattle Breeding at the Central Livestock Station.

The cattle breeding programme was reviewed in detail in the last annual report and action along these lines has been continued.

By the end of the year the size of the herd had attained 91 cattle units of which 42 cows were in milk. The total quantity of milk produced was 242,007 lb. as compared with 177,633 lb. in the previous year.

Preliminary investigational work was continued in connection with the initiation and establishment of an artificial insemination organisation.

2. Sheep

The flock now consists of 4 adult rams, 10 breeding ewes, 9 young ewes and 6 young rams. The comparison continues between the local Black Belly sheep and the progeny of the various crosses between the imported Wiltshire Horn sheep and the local Black Belly. Preliminary indications are that there is much in favour of the cross. The monthly weight gains for five Wiltshire Horn x Black Belly (First Cross) and five pure bred Black Belly sheep are shown in the Appendix.

3. Pigs

Two pure bred Large Black in-pig sows were imported from England and have since farrowed. The progeny of their first litters are being retained for replacements at the Central Livestock Station and District Agricultural Stations. Future litters will be available for distribution to the general public. The pig section consisted of 2 boars and 7 breeding sows at the end of the year under review. Twenty-three young pigs for breeding purposes were sold to the public and several were reared for replacements at the Central Livestock Station and District Agricultural Stations.

4. Goats

Pure bred British Alpine and Saanen bucks and does are being maintained at the Central Livestock Station. One pure bred Saanen buck out of imported parents was purchased from St. Kitts during the year. The goat section attained a total of 14 goats units, and 3 pure bred does kidded during the year.

5. Poultry

The poultry section has been expanded to meet the increased demand for week old chicks. Importations of Kauder White Leghorn chicks were made from the United States during the year. Just over one thousand chicks were hatched and distributed during the year.

SECTION XI.

ANIMAL HEALTH

By

M. B. PROVERBS
Veterinary Officer.

The health of Government owned livestock has been maintained at a satisfactory level during the year. The only major outbreaks of disease occurring in the Colony during the period under review were the serious epidemics of Fowl Cholera and Fowl Typhoid affecting poultry.

Investigations into existing animal and poultry diseases throughout the island have been continued.

Review of Diseases

(1) Mastitis in Dairy Cows:

The preventitive measures consisting essentially of strict dairy hygiene, efficient milking, combined with penicillin treatment of all cows at the 'drying off' stage have been continued at the Central Livestock Station, District Agricultural Stations and the Mental Hospital Dairy Farm. Results so far obtained have been good and would appear to warrant the expense of the penicillin involved in such prevention, and the incidence of mastitis during the dry period and immediately after calving has been appreciably reduced. Reports from two large dairies where mastitis was a major problem and which have adopted similar measures confirm the results so far obtained at the Government farms.

(2) Sterility in Dairy Cows:

This has always been a major problem among dairy herds in all parts of the world, and a problem which is being investigated by many research workers in different countries. The causes of sterility are so numerous that almost every case has to be diagnosed and treated individually. In Barbados the frequent use of communal bulls has been largely responsible for the spread of venereal diseases among cattle, and sterility from this cause is very prevalent.

There has been an appreciable increase in the incidence of sterility among dairy cattle at the Central Livestock Station and District Agricultural Stations during the year. It was at first thought that this may have been the result of over-use of the bulls. Artificial insemination was consequently commenced, and intervals between collections were controlled at not more than one collection every five days. Temporary improvements in fertility were noted, but results were subsequently found to be not altogether satisfactory. Further investigational work is in progress.

(3) Venereal Diseases of Cattle:

Brucellosis and Trichomoniasis have both been confirmed in the Colony, and the possibility of Vibrio foetus infections is at present undergoing investigation. Bulls at the District Agricultural Stations and a grade bull main-

tained at the Central Livestock Station for use on peasant stock, have become infected through serving infected animals. They subsequently had to be destroyed. It was consequently decided to stop all natural services at the Central Livestock Station, and artificial insemination only is now practised.

A course of instruction was given to the Peasant Agricultural Instructors in charge of the various District Agricultural Stations in the technique of artificial insemination and at five of the six stations cows are already being inseminated with semen which is delivered thrice weekly. It is hoped that it will be possible to gradually reduce the number of bulls at present being maintained at the stations when the use of artificial insemination becomes more generally accepted and widely adopted.

The use of artificial insemination, in my opinion, will greatly reduce the incidence of venereal disease and consequent infertility, since the grade bulls being used for this purpose have never been used for natural service and have therefore not been exposed to possible infection through natural service.

(4) Fowl Cholera and Fowl Typhoid:

The severe epidemics of these two poultry diseases which at one time threatened the poultry industry of the whole island has fortunately been brought under control. The disease first made its appearance in the Brittons Hill District of St. Michael, from where it very rapidly spread to all parts of the island. Information about the disease and precautionary measures to be taken were published in the press, broadcast over Rediffusion and circulated by Peasant Agricultural Instructors in the various parishes. A suitably combined vaccine was obtained and hundreds of birds throughout the island were vaccinated with excellent results. Many other West Indian Islands suffered and some are still suffering severe losses as a result of epidemics of these diseases.

TABLE I.

Veterinary Inspection of Animals prior to Export

Dogs	Goats	Sheep	Rabbits	Cats	Budgerigas	Heifers	Bulls	Chickens	Turkeys	Geese	Horses
69	23	21	22	9	2	5	3	19	4	3	71

TABLE II.

Veterinary Inspection on arrival of Imported Animals

Dogs	Goats	Asses	Pigeons	Cats	Mules	Pigs	Bulls	Horses
68	8	45	4	6	21	17	2	157

SECTION XII

FISHERIES

BY

D. W. WILES,

Fishery Officer

The activities of the Fisheries Division for the year under review may be considered under the following heads :—

A. Issue of loans to boat-owners.
B. Experimental Fishing with "Investigator" and Importation of Cotton Meshing.
C. Beach Improvements.
D. Marketing.
E. Registration of Fishing Fleet; loss of life and boats during 1951-1952.
F. Government assistance to Fishermen in connexion with disaster of December 2nd and 3rd, 1951.
G. Replacement of lost Fishing Boats.

A. Issue of loans to boat-owners.

Continued assistance was rendered to fishermen during the year under review. The Loan Scheme which was started in 1943, is now operated by a Revolving Fund totalling $50,000.00. During the present year, 118 loans were sanctioned, totalling $16,007.90, making a total of $41,223.20 sanctioned from the Revolving Fund. The sum of $10,273.16 was repaid to this Fund during the year; total repayments to the Fund now amount to $14,347.11. All advances previously made under Resolutions, are now repaid to a Redemption Fund. Repayments made to this Fund during the year amounted to $7,430.49, making a grand total of $59,303.23 repaid to this Fund.

B. Experimental Fishing with "Investigator".

During April and May of 1951, the "Investigator" was engaged in furthering the use of gill nets for flying fish capture to focus the fisherman's attention on this method. Many valuable catches were returned; and it was noticed that some fishermen and boat-owners were becoming interested in this new method for capturing the flying fish.

Importation of Cotton Meshing.

In order to further develop the gill net method of capturing the flying fish, 1,000 yards of gill net was imported by the Fisheries Division and resold to a number of boat owners in small lengths. Instruction in gearing the nets was given to the men, and towards the end of the 1951 flying fish season (May—July) only those boats equipped with gill nets were returning with worthwhile catches. During the 1952 season the popularity of the gill net rapidly increased and some 4,000 yards of net were sold through normal trade channels. The use of these nets has been reflected in the large catches returned during the 1952 season.

Introduction of the Ring Gill Net.

Towards the end of May 1951, the possibilities of another method of catching flying fish, namely, by means of a ring gill net, were investigated; since then this method has been developed and improved on. Very profitable catches have resulted from the use of this new net and information concerning its use can now be passed on to the local fisherman.

This new method involves the seining of the flying fish, by the use of a net 50 yards long by 24 feet deep, having pursing rings fastened to the lead line. One end of the net is floated to windward of the drifting boat, and the far end is then hauled to the boat by means of a rope attached to it. On every occasion that this net was used, large catches of fish were taken. For example, 7,900 fish have been taken in four hauls of this net. One particularly advantageous feature of this net is that it can be operated from small or large boats, and greatly increased catches are expected from the use of this new net. It is believed that this is the first time that flying fish have been "seined".

This net was designed by this Division and was made up locally by the crew of "Investigator" under the supervision of the Fishery Officer.

Other activities.

Some work on deep sea fish pots was tried with very moderate success owing to shortage of bait in the Bridgetown area and many other adverse factors; by September the boat began a programme of bank locating and a survey of the Western coast by means of depth record soundings, in order to acquire more detailed knowledge as to where larger nets could be used with safety. This programme will be continued during the hurricane sason of 1952. From mid-September, "Investigator" concentrated on further experiments with baits, lines, wires, etc., for the capture of the Wahoo or King fish; many useful methods were learned and passed on to the local fisherman for his use.

Work on Wahoo investigation continued until the end of January, 1952, when the flying fish season began. Inasmuch as many boats were destroyed in December, 1951, "Investigator" has concentrated on flying fish capture to the end of the period under review.

At the close of the flying fish season "Investigator" went on dock and was duly cleaned and refloated.

C. Beach Improvements.

(a) The construction of a road leading to Foul Bay beach was started towards the end of 1951 and is more than two-thirds completed. Work was, however, suspended when men were urgently needed for work on the Seawell runway.

(b) Final acquisition of land at Payne's Bay was completed by the end of the financial year and the Public Work Department is proceeding with the construction of the standard type of beach shelter.

D. Marketing.

During the year much attention has been focused on marketing conditions prevailing in the Island and certain conditions have been considered by the Fisheries Committee from time to time; plans are being finalised for the erecting of a fish market at Speightstown including proposals for storage and the better marketing of fish.

Oistins Market.

It was found necessary to have a wire enclosure erected around the counter of this market. Since this has been done, order has been maintained and boat-owners and fishermen have expressed satisfaction.

E. Registration of Fishing Fleet, loss of life and boats during 1951-1952.

The registration of the Fishing Fleet was carried out between October — December 1951, and the following Schedule show the numbers registered:—

Parish	Flying Fish	Pot & Sea Egg	Seine	Flying Fish boats lost in rough weather of December 1951
St. Michael	174	76	—	8
St. James	109	121	—	16
St. Peter	43	59	1	—
St. Lucy	51	30	—	2
St Joseph	43	1	—	1
St. John	35	3	2	—
St. Philip	81	64	—	2
Christ Church ..	96	60	1	—
	632	414	4	29

Loss of life and boats during fishing season 1951-52.

The loss of the life of one fisherman as a result of a boat sinking at sea is recorded with regret.

Twenty-one boats were lost at sea during the year while 29 more were completely wrecked in the surf on the occasion of heavy seas on the 2nd and 3rd December, 1951.

F. Government Assistance to Fishermen due to disaster of December 2nd and 3rd, 1951.

Eighty-three boats were damaged by the rough surf experienced on the coast from Carlisle to Half Moon Fort on December 2nd and 3rd, 1951. Twenty-nine boats were declared total losses, while 54 others were treated as repairable.

The Legislature provided the sum of $70,000.00 as an emergency measure for expenditure on repairs and replacements Immediate attention was given to the welfare of fishermen who were, as a consequene, without means of a livelihood and by means of a fund established through Public Subscription and a Government Grant, an allowance of $5.00 a week was given to fishermen and boat-owners who were solely dependent on their boat for a living. These funds distributed $8,253.68 in 1,651 payments over a period of seven weeks.

G. Replacement of lost Fishing Boats.

Immediate assistance was given to boat-owners for the repair of damaged boats. Working crews and shipwrights were organized all along the coast. By the end of February many of these boats had been refloated and by the end of March the repair programme had been almost completed.

The replacement of the boats completely lost is being dealt with by the Fisheries Division. It was necessary to acquire power-driven tools and erect work sheds to enable the work to proceed rapidly. Orders for timber wood in log form were placed with several Governments throughout the Caribbean area Up to the end of March, nineteen pieces of green-heart suitable for keels had

been received. In order that this work should proceed as quickly as possible Government gave permission to cut mahogany and white wood trees from "Summervale" woods and with this timber the building programme was commenced at the Reef by the middle of January.

The supply of many essential pieces of commercial lumber being unavailable in the island, special orders have been despatched to satisfy the requirements. Canvas for sails was ordered through the Crown Agents and has arrived and sailmaking is well advanced. A very limited supply of spruce board had been acquired locally together with a small shipment of Silver bali, and it is with this lumber and mahogany from Government-owned lands that work is proceeding as far as possible.

It is encouraging to report that between the end of January—end of March, thirty complete sets of timber frames had been cut and made ready for erection. Keels arrived in Barbados on the 28th March, and the first prepared keel was laid by the 30th March. It is expected that all of these boats will be replaced before the beginning of the next fishing season.

General Fishery Survey.

Between April and June, 1951, large numbers of flying fish were taken on the South Western, right through the western coast to the north-eastern section of the Island, and fishermen are to be congratulated for having taken the risks that were necessary to get these fish; especially those boats that fish off the north-eastern section of the Island.

At the close of the flying fish season 1951, it was felt that the future of gill nets as a means of increasing the capture of flying fish was assured, and larger stocks were ordered.

Pot fishing was maintained on a fairly large scale but with the use of fewer pots than in previous years. The reduction in the number of pots is mainly due to the high cost of mesh wire.

Turtle fishing with nets was also lucrative especially for meat. Shell is being held by the fishermen.

The sea-egg (Sea-Urchin) season which legally began on the 1st of September, had been subjected to a large degree of poaching during July and August and, as a result, did not last as long as had been hoped. Further consideration is being given to ways and means of enforcing the close season.

Catches of Bream and Snapper were sporadic, the size of the catches being to some extent dependent upon the availability of good bait. Some boats turned to King fishing by mid-October and many useful catches of Waho (King fish) were recorded. The catching of fish began shortly after mid-November, and the Bathsheba and Martin's Bay areas returned the largest catches for many years.

Flying fishing has been more successful on the eastern side of the Island during the January—March period, and very useful catches were recorded from bay to bay.

It has been observed that flying fish travel mainly in the prevailing current. It is suspected that this current is carrying the Plankton life on which they feed or that the current may be too strong for them to resist it in order to travel in other directions. Work on this aspect of flying fish research will be continued until it is possible to predict their movements with reasonable certainty.

It is encouraging to note that some 500 boats are using gill nets as an added means of capturing flying fish. As a result, some areas have reported that the 1951-52 flying fish season has been one of the best in many years.

PART IV.

FINANCIAL STATEMENT

Expenditure and Revenue for the Financial Year 1951-52.

EXPENDITURE

Recurrent

Personal Emoluments (Established Staff)	$109,218.95
„ „ (Unestablished Staff)	4,355.14
Travelling Allowances	19,750.57
Exhibition Expenses	943.76
Expenses in Control of Cotton Diseases (Salaries of Sub-Inspectors)	3,520.00
Stationery	941.31
Library	492.66
Destruction of Rats and Beetles	1,100.88
Insurance of Livestock	489.96
Experimental Stations	58,117.54
Chemical Laboratory	5,284.88
Entomology	14,125.43
Fisheries	11,043.51
Veterinary—Upkeep of Veterinary Laboratory	729.74
Propagation of Trees	1,731.11
Tax Contribution Payments	567.87
Government Lands—Upkeep and Purchase of Grass	402.21
Pine Plantation	44,302.00
	$277,117.52

Non-Recurrent

Equipment for Veterinary Laboratory	844.38
„ „ Chemical „	2,243.36
Furniture and Equipment	740.76
Roof for Irrigation Tank	923.72
	$ 4,752.22

REVENUE

Codrington Experiment Station—Field Produce	$ 7,308.14
Botanic Station:	
Ornamental and Useful Plants	543.05
Deposits on plant pots	1,022.36
Vegetable Seed and Insecticides	12,156.37
Proceeds from sale of Casuarina trees etc.	424.36
Chemical:	
Analyses of Commercial Sugars	4.80
Analyses of Miscellaneous Samples	321.81
Entomological:	
Sale of old wheat	262.00
Inspection of private buildings for Wood Ants	173.00
Pine Plantation and Central Livestock Station	42,864.09
	$ 65,079.98

PART V

AGRICULTURAL LEGISLATION

Department of Science and Agriculture (Amendment) Act 1951 (1951-14)

The aim of this Act is to eliminate from the Department of Science and Agriculture Act 1925-5 paragraphs X and XI of Section 8 which requires the Director of Agriculture to submit to the Education Board, and carry out when approved, a scheme for providing instruction in Natural and Agricultural Sciences to the pupils of Harrison College; arranging for the delivery of public lectures by the officers of the Department of Agriculture; and making a report to the Education Board on the teaching thus carried out. These requirements on the part of the Director of Agriculture are no longer necessary in view of the transfer of the responsibility of Science teaching from the Director of Agriculture to the Headmaster of Harrison College.

Barbados Fancy Molasses Production and Export (Amendment) Act, 1951 (1951-25)

This Act amends section 14 of the Fancy Molasses Production and Export Act, 1937, under which fancy molasses produced in any one year may be exported, under quota, up to the 31st of May of the following year so as to permit the sale and exportation of fancy molasses in containers not exceeding ten wine gallons each in order to encourage the canning of such molasses and to establish a market therefor.

Sugar Industry (Rehabilitation, Price Stabilization and Labour Welfare) (Special Levy) Act, 1951.

An additional levy on sugar and molasses manufactured in this island during the years 1951-1953, in certain circumstances, is imposed by this Act and is made payable, in the first instance, to the Sugar Production and Export Control Board and then to the Governor-in-Executive Committee to be applied to the Labour Welfare Fund formed by Section 19 of the Sugar Industry (Rehabilitation, Price Stabilization and Labour Welfare) Act 1947.

Underground Water Control Act, 1951.

Provision is made under this Act for the establishment of a Water Board to control the use of the underground sources of water supply in this island and for other matters connected therewith.

Sugar Industry (Rehabilitation, Price Stabilization and Labour Welfare) (Local Consumption) Act, 1952.

The Sugar Production and Export Control Board is required to pay to the Governor-in-Executive Committee all moneys received by way of a levy on sugar manufactured in this island during 1952 and sold for consumption in this island, and the Governor-in-Executive Committee may expend any moneys so received for the purpose of stabilizing the retail price of sugar sold for consumption in this island, or of any class or classes of such sugar in such a manner as the Governor-in-Executive Committee may deem expedient.

PART VI

LIST OF PUBLICATIONS ISSUED BY THE DEPARTMENT OF SCIENCE AND AGRICULTURE AND B.W.I. CENTRAL SUGAR CANE BREEDING STATION FROM 1925 TO DATE

Department of Science and Agriculture

Reports:

Report on the Sugar Cane Experiments for the Season between 1923-25, by J. P. D'Albuquerque, M.A., F.I.C., F.C.S.

Report on the Sugar Cane Experiments for the Season between 1924-26, by J. P. D'Albuquerque, M.A., F.I.C., F.C.S.

Report on the Department of Agriculture, Barbados, 1925-26.

Annual Report of the Department of Agriculture, 1926-27.

Report of the Department of Agriculture, Barbados, 1927-28.

Annual Report of the Department of Science and Agriculture, 1928-29.

Report of the Department of Science and Agriculture, Barbados, 1929-30.

Report of the Department of Science and Agriculture, Barbados, 1930-31.

Agricultural Journals:

Vol. 1, No. 1, Jan. 1932 (out of print)	An Investigation into the Evolution of Sugar Cane Varieties by Breeding in Barbados, 1887-1925, with a discussion on the application of the Findings to the present day Scheme of Work, by A. E. S. McIntosh, B.Sc., Ph. D.
	A Survey of the Position of *Phytalus smithi*, Arrow ,and its Natural Enemies in Barbados, by R. W. E. Tucker, M.A., B.Ed.
	The Scientific Control of Pan Boiling, by S. J. Saint, M.Sc., Ph.D.
	The Status of *Trichogramma* as a control of *D. saccharalis* in Barbados, by R. W. E. Tucker, M.A., B.Ed.
	The Inversion of Sucrose in Syrup Manufacture, by C. A. Coppin, B.A.Sc.
	Some Aspects of the Flora of Barbados, by F. Hardy, M.A., F.G.S.
	Memorandum on the Cotton Situation in Barbados.
Vol. 1, No. 2, April 1932.	Report on the Work of the Department of Science and Agriculture for the Year Ending June 30, 1932. Some Aspects of the Flora of Barbados (Cont'd) by F. Hardy, M.A., F.G.S.
Vol. 1, No. 3, July 1932.	Report of the Geneticist for 1931-32. Some Aspects of the Flora of Barbados, by F. Hardy, M.A., F.G.S.
Vol. 1, No. 4, Oct. 1932.	A Discussion of the Results of Manurial Trials carried out on Sugar Cane in Barbados, 1928-32. Some Aspects of the Flora of Barbados, by F. Hardy, M.A., F.G.S.

Vol. 2, Nos. 1 & 2, April 1933.	Report on the Work of the Department of Science and Agriculture for the Year Ending June 30, 1933. Some Aspects of the Flora of Barbados (Concluded) by F. Hardy, M.A., F.G.S.
Vol. 2 No. 3, July 1933.	Report of the Geneticist for the Year 1932-33.
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Vol. 4 No. 1, Jan. 1935 (out of print)	Manurial Trials with Sugar Cane. The Control of *D. saccharalis* in Sugar Cane in Barbados by frequent liberation of mass-reared *Trichogramma*, by R. W. E. Tucker, M.A., B. Ed.
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Vol. 5 No. 4, Oct. 1936. (out of print)	A Preliminary Investigation into Cane Varieties and Infestation by *D. saccharalis,* by R. W. E. Tucker, M.A., B.Ed.
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No. 4.	Compost Making.
No. 5. (out of print)	Rabbit Keeping in Barbados.
No. 6, Aug. 1942.	The Care and Maintenance of the Milch Goat in Barbados
No. 7.	The Growing of Food Crops.
No. 8. (out of print)	Hints to Cotton Growers.
No. 9, Oct. 1942	The Selection and Storage of Seed Corn in Barbados.
No. 10, Oct. 1942.	(1) Possible Means for an Efficient Use of a Large Sweet Potato Crop. (2) War-time Rations for Livestock. (3) The Storage of Sweet Potatoes in Clamps.
No. 11, Nov. 1942.	Ways of Cooking Sweet Potatoes.
No. 12. (out of print)	Recipes for the Use of Local Foodstuffs.
No. 13.	Recipes for the Use of Cassava Flour.
No. 14, Nov. 1945.	The Use of D.D.T. in Barbados.
No. 15, Oct. 1947.	Contour Farming.

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No. 17, July 1949. Hints on the Growing of Citrus Trees.

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No. 1, Jan. 1944. Inventory of the Barbados Rocks and their Possible Utilization, by Alfred Senn, Ph.D.

No. 2, Aug. 1944. (out of print) The Culture of Garden Vegetables in Barbados, by D. M. Hanschell, B.Sc.

No. 3. Notes on West Indian Hurricanes with Special Reference to Barbados, by C. C. Skeete, B.A.

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No. 3, Sept. 1934.	Report on a Visit to Jamaica, June 1934, by A. E. S. McIntosh, B.Sc., Ph.D., Geneticist.
No. 4, Nov. 1934 (out of print)	Report on a Visit to Grenada, by A. E. S. McIntosh, B.Sc., Ph.D., Geneticist.
No. 5, Feb. 1935 (out of print)	Investigations into the Root Development of the Sugar Cane in Barbados. (i)) Root Development in several Varieties under one Environment, by G. C. Stevenson, B.A., A.I.C.T.A., Assistant Botanist, and A. E. S. McIntosh, B.Sc., Ph.D., Geneticist.
No. 6, June 1935.	An Account of the Policy and Methods Employed in the Breeding and Initial Stage of selecting Sugar Cane Seedlings, by A. E. S. McIntosh, B.Sc., Ph.D., Geneticist.
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No. 13, June 1937.	Report on a Second Visit to Grenada, April 1937, by A. E. S. McIntosh, B.Sc., Ph.D.
No. 14, June 1937.	A Botanical and Agricultural Description of Recently Produced Commercial Seedlings, by A. E. S. McIntosh, B.Sc., Ph.D.
No. 15, July 1937.	Report on a Visit to St. Kitts and Antigua, June 1937, by A. E. S. McIntosh, B.Sc., Ph.D.
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No. 30, Dec. 1949. (out of print).	Report on a Visit to The Dominican Republic, August 1949, by G. C. Stevenson, B.A., A.I.C.T.A.
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No. 34, Feb. 1951.	Report on a Visit to British Guiana, January—February, 1950, by G. C. Stevenson, B.A., A.I.C.T.A.
No. 35, June 1951.	Report on a Visit to Guadeloupe, April 1951, by G. C. Stevenson, B.A., A.I.C.T.A.
No. 36, June 1951.	Report on a Visit to St. Lucia and Grenada, July, 1951, by G. C Stevenson, B.A., A.I.C.T.A.

APPENDIX I.

METEOROLOGICAL OBSERVATIONS RECORDED AT THE METEOROLOGICAL STATION, CODRINGTON

Height above Sea Level 181 feet

Latitude 130° 7′ 36″ N. Longitude 59° 35′ 57″ W.

The following are the summaries of the observations recorded for the year 1951. The details are given in Appendix II.

Barometric Pressure. The records refer to observations made at the hours of 9.00 a.m. and 3.00 p.m. only, and are expressed in inches of mercury. During the year 1951 the mean pressure corrected for temperature and gravity and reduced to sea level was at 9.00 a.m. 29.961 and at 3.00 p.m. 29.890 the highest pressure recorded being 30.059 on the 16th of January and the lowest 29.794 on the 27th of October. For the ten-year period 1941—50 the average barometric pressure was at 9.00 a.m. 29.979 and at 3.00 p.m. 29.906. The highest pressure recorded at 9.00 a.m. during the ten-year period was 30.131 on the 21st of February, 1946, and the lowest pressure recorded at 3.00 p.m. was 29.658 on the 12th of November, 1946.

Temperature. The daily mean maximum temperature for the year 1951 was 84.7°F. and the daily mean minimum 73.8°F. The maximum extreme for the year was 88.5°F. registered on the 31st of March; the 8th of August and the 28th of October, and the minimum extreme was 62.0°F. registered on the 6th January. The average monthly mean temperature was 79.2°F. the highest monthly range 22.5°F. and the lowest 15.0°F; the mean monthly range being 17.2°F. For the ten-year period 1941-50 the daily mean maximum was 85.3°F. and the daily mean minimum 72.0°F. During the same ten-year period the average monthly mean temperature was 78.6°F.; the maximum extreme was 95.0°F. on the 21st of August, 1943; the minimum extreme 60.5°F. on the 29th February, 1944, and the 11th and 15th January, 1949; and the average monthly range 19.1°F.

Tension of Vapour and Relative Humidity. The mean tension of vapour for the year 1951 was at 8.00 a.m. .793 and at 4.00 p.m. .754. The mean relative humidity was at 8.00 a.m. 78.4 per cent. and at 4.00 p.m. 69.9 per cent.

Wind. The daily (24-hour period) mean velocity of the wind during the year 1951 was 8 miles an hour. Records were kept of half-daily or twelve-hour periods from 6.00 a.m. to 6.00 p.m. and 6.00 p.m. to 6.00 a.m. The maximum velocity for any such twelve-hour period was 18.8 miles an hour, recorded between 6.00 a.m. and 6 p.m. on the 2nd of February and the minimum velocity 2.1 miles an hour recorded between 6.00 p.m. and 6.00 a.m. on the 26th of October and the 26th of November. The average daily (24-hour period) velocity for the ten-year period ended 1950 was 9.2 miles an hour.

Rainfall. The rainfall measured at the Government Meteorological Station during the year 1951 amounted to 68.54 inches Rainfall was recorded on 221 days, the greatest fall being 2.59 inches on the 17th of February. For the ten year period 1941-50 the average total rainfall was 49.77 inches, and the average number of days annually on which rain fell was 178.

Rainfall of the Island. The average total rainfall for the year 1951 from 69 stations was 90.24 inches, being 30.34 inches above the average for the hundred years ended December 31, 1950, which was 59.90 inches. Details are given in Appendix III.

APPENDIX II.

Meteriological Report for 1951

MONTH	Barometric Pressure Reduced to 32°F Latitude 45° and Mean Sea Level					TEMPERATURE °F								TENSION OF VAPOUR			RELATIVE HUMIDITY			Velocity Miles per Hour	Daily Mean Sunshine (hours)	Rainfall (Inches)	No. of Days on which Rain fell
	9 a.m.	3 p.m.	Mean	Highest	Lowest	Max. Mean	Min. Mean	Max. Extreme	Min. Extreme	Mean for Month	Range for Month	Dew Point 8 a.m.	Dew Point 4 p.m.	8 a.m.	4 p.m.	Mean	8 a.m.	4 p.m.	Mean				
January ...	29.980	29.897	29.938	30.059	29.817	82.1	71.4	84.0	62.0	76.7	22.0	68.9	67.8	.706	.684	.695	78.2	86.9	72.5	8.7	8.4	2.73	12
February ...	29.958	29.883	29.920	30.023	29.823	81.8	74.4	86.5	71.5	78.1	15.0	71.0	69.5	.760	.723	.741	83.9	73.5	78.7	8.7	6.3	12.24	16
March ...	29.947	29.876	29.912	30.007	29.830	84.3	71.2	88.5	66.0	77.7	22.5	68.5	67.2	.694	.669	.681	72.6	63.3	67.9	7.9	8.1	0.54	10
April ...	29.986	29.907	29.947	30.017	29.830	85.3	72.2	87.5	68.5	78.7	19.0	70.7	69.4	.751	.720	.735	74.4	65.3	69.8	8.2	8.2	5.65	19
May ...	29.970	29.902	29.936	30.013	29.838	86.8	75.3	88.0	71.5	81.0	16.5	72.3	70.3	.795	.752	.773	73.1	64.8	68.9	8.4	9.9	1.54	14
June ...	29.982	29.931	29.956	30.025	29.842	85.6	76.2	87.5	71.0	80.9	16.5	72.4	70.6	.799	.750	.774	76.0	67.8	71.9	10.5	7.1	6.65	20
July ...	29.987	29.931	29.959	30.032	29.881	85.7	75.4	87.5	72.5	80.5	15.0	73.4	71.7	.819	.778	.798	77.9	69.4	73.6	8.0	8.1	5.46	22
August ...	29.943	29.890	29.917	30.021	29.883	85.8	75.2	88.5	73.0	80.5	15.5	74.6	72.6	.859	.806	.832	80.6	72.5	76.5	6.5	8.0	10.16	21
September ...	29.943	29.871	29.907	29.994	29.825	85.3	74.1	87.5	72.5	79.7	15.0	75.1	73.1	.872	.820	.846	82.4	74.9	78.6	5.7	6.9	8.90	21
October ...	29.933	29.852	29.893	30.018	29.824	86.3	73.7	88.5	70.5	80.0	18.0	74.2	72.4	.845	.797	.821	79.6	70.5	75.0	7.4	8.6	2.87	25
November ...	29.925	29.840	29.883	29.983	29.794	84.4	73.6	86.0	70.5	79.0	15.5	74.2	72.6	.842	.805	.823	82.4	75.9	79.1	7.4	7.5	6.78	24
December ...	29.979	29.900	29.939	30.019	29.842	83.3	72.5	85.5	70.0	77.9	15.5	72.3	70.5	.780	.748	.764	80.3	73.3	76.8	8.5	7.6	5.02	17
TOTAL ...	359.533	358.680	359.107	360.211	357.994	1016.7	885.2	1045.5	839.5	950.7	206.0	867 6	847.7	9.522	9.052	9.283	941.4	838.1	889.3	95.9	94.7	68.54	221
AVERAGE ..	29.961	29.890	29.925	30.018	29.833	84.7	73.8	87.1	69.9	79.2	17.2	72.3	70.6	.793	.754	.773	78.4	6.99	7.41	8.0	7.9	5.71	18

APPENDIX III.

Barbados Rainfall from January to December, 1951.

Name of Station	Number of Stations	January		February		March		April		May		June		July		August		September		October		November		December		TOTAL.	
		Days	Inches	Days	Inches	Days	Inches	Days	Inches	Days	Inches	Days	Inches	Days	Inches	Days	Inches	Days	Inches	Days	Inches	Days	Inches	Days	Inches	Days	Inches
District "A"—St. Michael																											
Lowlands ...	6	11	3.37	15	12.18	6	.91	15	5.90	12	1.58	15	7.13	18	5.75	19	10.60	16	8.34	16	2.89	22	8.40	15	6.03	180	73.08
District "B"—Christ Church																											
Lowlands ...	7	12	3.25	13	7.34	6	2.36	14	5.07	9	1.51	13	6.21	18	3.77	19	12.23	17	8.79	15	2.97	21	9.68	18	7.58	175	70.76
—St. George																											
Highlands ...	2	14	4.69	16	11.97	5	1.78	16	6.38	16	2.64	16	7.60	17	6.97	21	13.60	21	12.33	21	6.78	25	12.82	19	7.88	207	95.44
Lowlands ...	5	12	3.89	14	9.83	8	2.33	16	5.79	11	1.39	15	6.50	19	5.79	21	11.85	16	9.77	16	4.48	21	11.74	15	7.33	184	80.69
District "C"—St. Philip																											
Highlands ...	2	13	2.33	16	13.90	4	3.40	16	8.80	13	1.50	14	6.54	13	4.73	16	8.24	16	10.26	18	3.08	22	8.64	13	6.34	174	74.76
Lowlands ...	8	10	3.05	15	10.00	6	2.67	14	5.96	9	1.20	13	5.67	16	4.92	18	9.71	16	10.48	13	2.47	21	9.26	15	6.45	166	71.84
—St. John																											
Highlands ...	6	16	4.29	18	16.54	9	4.68	18	8.09	15	2.60	17	8.13	19	6.45	21	12.22	19	12.91	20	4.42	24	11.56	18	8.36	214	100.25
Lowlands ...	1	9	2.90	15	17.29	6	4.50	12	9.54	12	1.95	14	7.18	16	6.32	19	13.51	17	10.72	17	3.78	21	12.38	18	7.20	176	97.27
District "D"—St. Thomas																											
Highlands ...	5	14	5.34	20	19.01	10	1.94	18	9.11	19	3.13	19	8.74	19	8.20	22	13.03	19	12.19	21	5.85	24	11.98	20	10.03	225	108.25
Lowlands ...	2	12	5.25	16	14.80	5	1.64	13	7.09	11	2.60	14	7.00	18	7.28	19	12.17	15	10.20	14	5.28	20	11.58	14	7.63	171	92.52
—St James																											
Highlands ...	1	9	3.29	20	21.46	8	1.84	19	15.30	12	3.34	18	11.09	20	8.07	20	16.46	18	12.22	18	7.16	22	11.77	20	13.76	204	125.76
Lowlands ...	6	12	3.65	16	10.81	4	.62	13	4.35	10	1.72	12	6.83	17	6.25	17	11.54	14	9.11	13	3.75	18	9.09	13	6.38	159	74.10
District "E"—St. Peter																											
Highlands ...	1	7	1.81	11	14.75	5	2.47	10	7.00	10	1.66	12	5.98	15	5.26	16	14.69	15	9.21	8	2.35	15	11.44	11	9.35	135	85.97
Lowlands ...	5	12	2.95	14	13.54	3	.53	13	7.16	10	2.04	15	8.50	15	5.75	19	14.35	14	9.95	13	5.24	18	9.31	12	9.90	158	89.22
—St. Lucy																											
Lowlands ...	3	9	1.95	15	13.85	6	1.29	13	5.02	10	1.82	14	7.01	19	5.86	18	13.08	17	9.83	15	5.17	17	9.85	14	6.78	167	81.51
District "F"—St. Joseph																											
Highlands ...	4	12	4.20	19	17.90	10	3.48	19	7.96	17	2.33	17	7.81	19	6.12	23	13.36	21	11.36	22	4.34	24	11.31	20	10.05	223	100.22
—St. Andrew																											
Highlands ...	2	9	3.10	15	17.27	8	2.25	15	9.43	13	2.21	19	8.46	14	5.74	17	15.46	17	10.91	17	4.99	18	11.38	18	12.62	180	103.82
Lowlands ...	3	8	2.74	13	15.93	7	2.38	15	6.98	9	2.08	15	6.55	16	5.25	20	15.97	19	9.73	15	3.76	20	12.19	16	12.04	173	95.60
Totals	69	201	62.05	281	258.37	116	41.07	269	134.93	218	37.30	272	132.93	308	108.48	345	232.07	307	188.31	292	78.76	373	194.38	289	155.71	3,271	624.36
Average		11	3.45	16	14.35	6	2.28	15	7.50	12	2.07	15	7.39	18	6.03	19	12.89	17	10.46	16	4.37	21	10.80	16	8.65	182	90.24